The Builder.

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Electrical Standards.

THE Board of Trade Electrical Standards Committee have completed their task, and the "Minutes of Proceedings and Evidence, Appendices, &c.," are now published in a Blue-book of some hundred pages.

Although much of the report furnishes reading of the very dreariest description, yet the subject is one of such paramount importance to both the suppliers and users of electricity, that the final conclusions arrived at should be carefully perused by all who are in any way interested in the subject.

More than fifteen years ago a Committee of the British Association agreed upon the adoption of the centimetre-gramme-second system of units for all purposes of physical measurement; but as the magnitudes of most of these units proved exceedingly inconvenient for electrical work, certain multiples and sub-multiples of the electro-magnetic system were named and recommended for practical use.

Standards were prepared, in accordance with the recommendations then made, and, although subsequent experiments have shown that they are not quite what they were intended to be, they are very approximately those now used by electricians, while the definitions still hold good. New units are derived from the old as the progress of measurement requires.

Strange as it may seem, no legal electrical standards have yet existed. If goods are sold by the yard and the purchaser doubts the accuracy of the yard measure used, it can be compared with certain carefully-preserved standards which have been declared by Act of Parliament to be the "yard;" but although, to take a single case, the fourth schedule of the model form of Provisional Order, issued by the Board of Trade in 1889, defined the unit of supply in terms of the "ampère" and "volt," there were no legal standards of current or electro-motive force with which ampères or volts, supplied by a company to a customer, could be compared in case of a dispute.

To meet the urgent want of such standards the Board of Trade appointed on December 16, 1890, a committee consisting of Mr. Courtney Boyle, C.B., Major P. Cardew, R.E., Mr. E. Graves, Mr. W. H. Preece, F.R.S., Sir William Thomson, F.R.S., Lord Rayleigh, F.R.S., Professor G. Carey Foster, F.R.S., Mr. R. T. Glazebrook, F.R.S., Dr. John Hopkinson, F.R.S., and Professor W. E. Ayrton, F.R.S., "to be a committee to consider and report whether any, and, if so, what, action should be taken by the Board of Trade under section 6 of the Weights and Measures Act, 1889, with a view of causing new denominations of standards for the measurement of electricity for use for trade to be made and duly verified." Sir T. W. P. Blomfield acted as secretary to the committee, and Mr. Chaney, Superintendent of Weights and Measures, was present at the meetings.

The Committee met for the first time on January 15 in the present year and agreed that draft resolutions should be prepared for discussion at the next meeting. This first draft named the standards, defined them in terms of the C.-G.-S. electro-magnetic units, and stated how the necessary standards should be obtained, but the formal business of the Committee was not really commenced until the next meeting, which was held on January 31. It was considered desirable to obtain the evidence of witnesses whose position in the various branches of electrical engineering would ensure their opinions being of value, and the following gentlemen were examined: — Mr. Thomas Parker, of the Electric Construction Corporation; Mr. Hugh Erat Harrison, of the Electrical Standardizing, Testing, and Training Institution; Prof. Silvanus Thompson, of the City and Guilds of London Technical College; Mr. R. E. Crompton, of Messrs. Crompton & Co.; Dr. J. A. Fleming, of University College; and Dr. Alexander Muirhead, of Messrs. Latimer, Clark, Muirhead & Co. One of the first questions discussed at the second meeting was the purpose for which these witnesses had been called; the conclusion at which the Committee arrived we give in the words of one of the members, "After we have resolved on our part of the business, we shall be able to give these gentlemen something on which they will give us sound and good evidence. *They will come here, and they will support us, and we shall then be in a very much stronger position.*" The italics are ours. That the duty of the witnesses,—who were chosen, we imagine, because they have for years past given the most careful consideration to the whole subject,—should be to come without an idea in their heads, and simply say how good everything was that had been prepared for them, seems at first sight odd, to say the least of it. If these gentlemen were told what was expected from them, they cannot be congratulated on the way in which they fulfilled their functions; they must be given credit for expressing approval, in the main, of the resolutions read to them, but the manner in which some of the witnesses presumed to have ideas of their own is certainly worthy of censure.

There is necessarily a great deal of repetition in the minutes, because, as we gather from Mr. Crompton's evidence, each witness was kept in entire ignorance of what had gone before. It will be better, therefore, to discuss, in order, the more important of the final resolutions presented to the President of the Board of Trade on July 23. The number prefixed in each case is the number of the resolution, of which there are sixteen in all.

It is decided generally:—

"2. That the magnitudes of these standards should be determined on the electro-magnetic system of measurement with reference to the centimetre as unit of length, the gramme as unit of mass, and the second as unit of time, and that by the terms centimetre and gramme are meant the standards of those denominations deposited with the Board of Trade."

Passing on to the individual standards—

"3. That the standard of electrical resistance should be denominated the ohm, and should have the value 1,000,000,000 in terms of the centimetre and second.

4. That the resistance offered to an unvarying electric current by a column of mercury of a constant cross sectional area of one square millimetre, and of a length of 106·3 centimetres at the temperature of melting ice, may be adopted as one ohm.

5. That the value of the standard of resistance constructed by a committee of the British Association for the Advancement of Science in the years 1863 and 1864, and known as the British Association unit, may be taken as ·9866 of the ohm.

6. That a material standard constructed in solid metal, and verified by comparison with the British Association unit, should be adopted as the standard ohm."

The above resolutions will be generally

accepted as clear and satisfactory, they will be found fault with only by the hypercritical, and the same may be said of numbers 9 and 10, which are as follows:—

"9. That the standard of electrical current should be denominated the ampere, and should be the value of one-tenth (0·1) in terms of the centimetre, gramme, and second.

"10. That an unvarying current which, when passed through a solution of nitrate of silver in water, in accordance with the specification attached to this report, deposits silver at the rate of 0·001118 of a gramme per second, may be taken as a current of one ampere."

The next resolution dealing with the standard of alternating current must be read carefully, as this standard presented great difficulties, and the subject was discussed at considerable length.

"11. That an alternating current of one ampere shall mean a current such that the square root of the time average of the square of its strength at each instant in amperes is unity."

"12. That instruments constructed on the principle of the balance, in which by the proper distribution of the conductors, forces of attraction and repulsion are produced, which depend upon the amount of current passing, and are balanced by known weights, should be adopted as the Board of Trade standards for the measurement of current whether unvarying or alternating."

The Committee congratulated themselves on the delightful simplicity of resolution 11, and that they were "telling the practical people what they have meant without knowing it all the time." The Chairman, however, rather spoilt matters by saying "I am bound to tell the Committee that I did speak to Sir Michael Hicks-Beach about this particular definition, and that it certainly frightened him a great deal. Sir Michael had consulted a gentleman of some practical knowledge of electricity on this point . . . . ," and apparently frightened *him* too. As this subject undoubtedly presents difficulties to even those persons who have a very fair practical knowledge of electricity, it is worth while entering into the matter at some little length, and considering the different kinds of electric current in use.

An *unvarying current* flows steadily in one direction, and may be compared with an unvarying stream of water in which the flow is the same at any instant.

An *alternating current* is constantly pulsating to and fro, never remaining steady for an instant. When it starts it rises to its highest value, whatever that may be, sinks to nothing, and immediately starts again in the opposite direction, rises to the same highest value as before, though now in the reverse direction, sinks to nothing and starts again in the original direction. In practice this process of reversal is repeated from 120 to 200 times in a second, and although the actual movement of electricity is great, yet, as a whole, no electricity permanently passes across any section of the conductor, for whatever quantity may be carried across in one pulse, exactly the same amount passes back again in the reverse pulse, which immediately flows. Neglecting the difference between spring and neap tides, a very similar alternating water-current takes places through the entrance to a harbour which is open to the sea. Starting at low tide, water flows *into* the harbour until high tide, when the stream stops; the tide turns, the stream reverses, and water flows *out* of the harbour until low water, the same quantity of water flowing out as had previously flowed in, when the process begins all over again. In the case of the water, however, reversal takes place once in twelve hours instead of some 200 times a second, as in the case of electricity.

In addition to the unvarying and alternating currents there is what may be called the *undulating current*, that is, a current which always flows in one direction but which varies in strength. The kind of current, in fact, which may be seen immediately below the first weir on a river. A constant stream of water tumbles over the weir, but when the tide goes out the level of the river falls, hence *more* water flows down the bed of the river than comes over the weir; when, on the contrary, the tide comes up, *less* water flows down the river than is supplied from the weir, since the water rises. Between, however, two high tides the total amount of water which has flowed away, in this irregular stream, is the same as the quantity that has been carried down in the regular or unvarying current which has been going on above the weir. It is, indeed, possible that currents of a more complicated character still may be used, compounded of two or more of the kinds named. The undulations of the current last described are, of course, in the case of electricity excessively rapid.

Every electrician is thoroughly familiar with the unvarying current, and measures it by means of a galvanometer, or, if greater accuracy is required, by some electrolytic method, such as that given in resolution 10. Balances are not so frequently used, and, in consequence, the precise function of the current then measured is often overlooked.

The details of most balances are rather complicated, but the general principle on which they are constructed is simple enough.

Suppose A and B to be two copper rings facing each other, and having a common axis. A is fixed, but B is movable, and if displaced by any force from its position of equilibrium, — that is, the position it takes up when no current is passing through the apparatus, — it can be brought back into that position by means of a spring or weights, which will measure the force acting upon it. Let a current of 1 ampere be sent round both A and B, from independent sources and in opposite directions. B will be repelled from A, and a force F required to maintain it in position. If 2 amperes are made to flow in A the force is 2 F, but if 2 amperes also flow in B, it becomes 4 F; similarly, if currents of 7 amperes flow in both rings, the force of repulsion is 49 F, and so on, since the total force is proportional to the product of the currents in the two circuits.

The rings may be connected in series so that the same current circulates in opposite directions round one after the other, the instrument can then be used to measure the *square of a current*, for with a current C the force measured will obviously be C^2 F, *i.e.*, a force C^2 times as large as that caused by 1 ampere of current. It must be clearly understood that the instrument primarily measures *force*, this force varies as the *square* of the current passing, so that the *square root* of this force gives a figure proportional to the current; knowing then the force indicated when 1 ampere flows we know by what current any force is produced. As the coils or rings are connected in series, if the current reverses the reversal takes place in both rings simultaneously, the relative directions are not changed and there is still repulsion, so that the instrument can be read when an alternating current is passing; though the same current would produce no effect on an ordinary galvanometer or electrolytic cell.

Now imagine a current flowing in one direction, but whose value changes from 1 to 7 amperes in such a manner that 1 ampere flows for a short interval of time, then 7 amperes for an equal interval of time, at the end of which the current drops to 1 ampere, but rises to 7 amperes again after another equal interval of time, and so on and so on. If these successive changes follow each other rapidly, that is, if the interval of time for which the current is 1 or 7 amperes is exceedingly short, then it will steadily deflect the needle of any galvanometer it may be sent through, and if such a current is measured by a galvanometer or a silver cell, both instruments will indicate the mean value of the current, or *the time average of the current*, that is $\frac{1+7}{2} = 4$.

Now if the same current is sent through the balance the coil B will be repelled for successive equal intervals of time with forces proportional to 1^2 and 7^2, and the constant force required to keep B in position will be proportional to the mean of these two,—that is, to $\frac{1^2+7^2}{2}$, but in using this instrument to measure current the square root of the readings has to be taken; hence the reading so obtained is $\sqrt{\frac{1^2+7^2}{2}} = \sqrt{\frac{50}{2}} = 5$, and the balance indicates 5 amperes. The balance then gives us, not *the time average of the current*, but *the square root of the time average of the square of the strength at each instant;* in other words, it measures a varying current in the manner prescribed in resolution 11. Let us call the value of the current, or rather the function of the current, as measured by the balance, b, then a balance is an instrument which will measure b for every conceivable kind of current, provided only its changes in value take place so rapidly that B can be kept in position by a single adjustment of the spring, for if the current rises and falls slowly B would move backwards and forwards with it.

A galvanometer, or silver cell, can also measure any kind of current, under similar conditions, if it is furnished with a commutator which sends all the pulses of current through the galvanometer in the same direction. Call the function of the current,—that is, the time average, which the galvanometer measures,—g. Then the points to which we wish to draw special attention are these: If the current measured is unvarying, b and g have exactly the same value; but if the current does vary, whether alternating or not, then b is always greater than g. The Board of Trade have therefore decided to use two different standards for the measurement of current.

This inconsistency was clearly seen by the Committee, but their argument appears to have been this:—Practical electricians have been measuring g for unvarying currents, and calling the current g amperes. They have measured b for alternating currents, and called the current b amperes, under the impression that they were measuring g. We will, therefore, define our standards for the measurement of these two kinds of current, so as to make them fit what is now the common practice. Mr. Harrison specially called the attention of the Committee to this, and the length at which the question was discussed, shows the difficulty felt. The pith of this witness's argument is this:—Measure b for all kinds of current, but don't call the standard the ampere,—call it something else; keep the word ampere for the quantity it has been hitherto understood to measure. As matters now stand, there is one kind of ampere to measure an unvarying current; there is another kind of ampere to measure an alternating current; but there is no standard at all by which to measure other kinds of current. This blank will have to be filled up some day.

The definitions of the standards of electrical pressure follow at once, by Ohm's Law, from those of current.

"13. That the standard of electrical pressure should be denominated the volt, being the pressure which, if steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.

14. That the electrical pressure at a temperature of 62 deg. Fahr. between the poles or electrodes of the voltaic cell known as Clark's cell, may be taken as not differing from a pressure of 1·433 volts, by more than an amount which will be determined by a sub-committee appointed to investigate the question, who will prepare a specification for the construction and use of the cell.

15. That an alternating pressure of one volt shall mean a pressure such that the square root of the time-average of the square of its value at each instant in volts is unity.

16. The instruments constructed on the principle of Sir W. Thomson's Quadrant Electrometer used idiostatically, and for high-pressure instruments on the principle of the balance, electrostatic forces being balanced against a known weight, should be adopted as Board of Trade standards for the

measurement of pressure, whether unvarying or alternating."

Some interesting evidence as to the use of the Clark cell as a standard of pressure was given by Dr. Fleming, Dr. Muirhead, and Mr. Crompton, all of whom said that its constancy was sufficient for all practical purposes.

The importance of these resolutions presented to the President of the Board of Trade can hardly be over-rated by those in any way concerned in electrical engineering.

How these standards will work in practice remains to be seen, but as the Committee was composed of some of the greatest electricians of the age, it may safely be assumed that their conclusions are, as a whole, the best that the present state of knowledge will allow.

NOTES.

THE second session of the International Congress on Accidents to Workmen, which would be more appropriately named the "Insurance of Workmen Congress," was far more satisfactory in the character of its discussions and in its results than the first. The pessimistic spirit which was strongly in evidence at the earlier congress, held in Paris in 1889, was found to have almost disappeared at the second session, which concluded on Saturday last at Berne. At both congresses, some of the most remarkable among the papers offered were furnished by M. Léturgeon, president of a beneficent institution, formed as early as 1859, among the masons and builders of Paris and the Department of the Seine, for purposes that are only now beginning to be properly appreciated in the industrial world and advocated in congresses. More than thirty years ago, sixty-four employers and employed in the building trades banded themselves together as a mutual assurance association, under the name of "La Chambre Syndicale de la Maçonnerie," and the account given by the president of that association towards the close of the Congress of Berne was one of its most interesting episodes. Long before either the Germans or the French of other trades had grasped even the possibility of uniting for such a purpose, the building trades of Paris had formed a practical and prosperous institution founded on the conviction that to guarantee the workmen from the risk of accidents, and also from maladies caused by the nature of their work, was not only humane and beneficent, but profitable and wise. The association distributes annually over 100,000 f. to recompense workmen or their families suffering in consequence of accidents, at a cost for administration of less than 400*l.* a year in expenses. Not the least remarkable feature of the working of the association is the fact that more than a million of francs have been distributed by it to workmen injured, without litigation, disputes, or friction of any kind, except in 2 per cent. of the cases. The association, though strictly one of mutual self-help, and in no sense eleemosynary, has annual *réunions*, where prizes of money, medals, and certificates are distributed by some important personage, the employers meeting their apprentices and their workmen on these occasions in the most amicable and fraternal spirit. The President of the Association raised a cheer in the congress when he declared that he regretted that they had never been able to get any of the notorious labour agitators to attend a distribution, to see the fervour of the hand-shakings between masters and men, for they would be less ready to denounce capital as infamous, or property as robbery, if they could be got to attend. The sum assured and the premiums paid are both in proportion to salaries. Thus, for an apprentice mason receiving 5 francs per day, 5 centimes (1 per cent.) would be paid, and for a competent stone-cutter, receiving 9 francs per day, 9 centimes (less than a penny). During the thirty years of the Association's existence, 12,065 accidents had been dealt with, compensation having been given amounting in the aggregate to 1,327,000 francs, or more than 53,000*l.* The fatal accidents were 186, costing 306,000 francs (12,240*l.*). The serious accidents, numbering 312, had cost 296,000 francs (11,840*l.*) The slighter accidents, which numbered 11,565, cost 727,000 francs (29,080*l.*). The original sixty-four members had now become 250. The committee was studying a pension scheme for aged workmen, which President Léturgeon hoped to be able to present in going order to the next Congress.

SWITZERLAND, which has been appropriately called the "land of conferences," is the scene of another Congress, that of the Literary and Artistic Association, among the members of which taking part in last Monday's debate was M. Chas. Lucas, the well-known Parisian architect. The discussions were repeatedly enlivened by the vigorous interventions of M. Charles Lucas on behalf of architecture. Strangely enough, neither in the English Copyright Bill of Lord Monkswell, introduced, but not carried to a division, in the last session of the British Parliament, nor in the Act passed this year on the same subject by the Congress of the United States, had architectural drawings and productions been thought of, although the protection of paintings and sculpture, and even of photographs and lithographs, had been amply provided for. Of course the protests of M. Charles Lucas were at once acceded to by the Congress, which passed the following resolution at the close of the first day's discussion:—

"The International Literary and Artistic Congress, assembled at Neuchâtel, recommends the various literary and art associations to unite in respectfully presenting to the Government of Great Britain, the report read before the Congress upon the proposed Copyright Bill and the observations made upon it in the discussion."

THE reductions in foreign letter postage rates which come into operation this week will be very welcome to many. In future, the postage on a letter to any part of the world (with the exception of a few places in the interior of Africa) will be 2½d. the half-ounce, which means, in many cases, a saving of 1½d. In the same way a uniform charge of 1d. will now be made for postcards to any foreign country. Of course, this had been arranged some time before Sir James Fergusson was called to be Postmaster-General, but, all the same, it is a matter for congratulation that his reign has been inaugurated by such a substantial reform. It would be a very great advantage, now that a uniform rate of postage is established, if a "Postal Union" arrangement could be devised whereby a stamp "for reply" might be sent from one country to another. For most people, the only way in which a reply can be obtained without cost to the correspondent abroad, is by means of a "reply post-card." There are many circumstances under which it is not at all desirable to use a post-card, and it is at present impossible for a person to adopt the familiar and convenient "stamp enclosed for reply," when writing to a foreign or colonial correspondent,—however desirous he may be to bear the cost of such reply,—unless he happens to be near the office of Messrs. Cook & Son, or some other accommodating "universal provider." We are not quite clear,—bearing in mind Mr. Henniker-Heaton's list of postal anomalies,—as to whether the uniform rate will be applicable to all letters sent *to* this country as well as to outward correspondence; but if such be the case, the difficulty might perhaps be met by the adoption of a universal 2½d. or 5 cent stamp, available between any of the countries in the Postal Union, and obtainable at any post-office.

THE programme of the Roman section of the German Imperial Archæological Institute presents this autumn a novel feature. The Institute has invited fifteen masters of German gymnasiums to go for a tour through Italy for the special purpose of studying ancient art. The tour is to be personally conducted by Professor Petersen, Dr. Hülsen, and Professor Mau, the secretaries (which is German in this case for directors and sub-directors) of the Institute. The party meets at Verona, the point at which the German has the happy luck usually to enter Italy; and though Verona has little to show of ancient art, one hopes the schoolmasters will not be too wholly specialist to vouchsafe it a glance. Thence they are to pass to Florence and Rome, to which a fortnight will be devoted, and then on to Naples, with Pompei at Paestum. It would be worth travelling a long way to go over Pompei with Dr. Mau. We have not yet heard of any such personally conducted tour for English public schoolmasters. Perhaps they would not like it. As it is they are a very travelled and, quâ Renaissance, a decidedly cultivated body. We are not so sure about their knowledge of classical remains. These may savour too much of schooltime, though Cambridge men have been to both Athens and Rome under the guidance of Professor Middleton.

THE results of some interesting and valuable experiments made at Saint-Eloy, in Auvergne, have recently been published in the "Comptes-Rendus Mensuels de la Société de l'Industrie Minérale." The object was to find the best method of treating timber with a view to its preservation underground. Seven different woods were selected—viz. (1) oak, thirty-five years old; (2) oak, twenty-seven years old; (3) fir; (4) pine; (5) birch; (6) beech; (7) poplar. Fifty-two discs, ¼ in. thick, were taken of each wood. Two of each series were kept dry above ground, and the remainder were placed in a cage in a damp mine underground, having a temperature of about 75 deg. Fahr. Two specimens out of each ten were not treated in any way, whilst the rest were protected by the following:—(A) Solution of sulphate of iron; (B) solution of sulphate of copper; (C) solution of chloride of zinc; (D) creosote; (5) oil paint; (6) immersed five minutes in tar. The specimens were examined at various periods, from six months to eight and a half years. The unprotected specimens were all destroyed in from two and a half to three and a half years, the order of durability being as follows:—Beech, Oak No. 1, Poplar, Oak No. 2, Birch, Fir, Pine. The preservative effects of the different substances is contained in the following table, which gives the increased durability, the unprotected specimens being taken as unity:—

	Oak No. 1.	Oak No. 2.	Fir.	Pine.	Birch.	Beech.	Poplar.
Tar	28·7	24·6	263·5	87·5	105·4	26·2	150·4
Chloride of Zinc	10·5	9·2	50·0	26·3	18·6	52·5	34·7
Oil Paint....	6·1	10·2	31·7	54·5	25·0	12·1	2·5
Sulphate of Copper....	42·1	26·4	12·0	8·0	1·8	2·5	15·5
Sulphate of Iron	18·0	12·5	12·1	4·2	4·7	3·5	2·9
Creosote	1·7	0·9	2·5	4·4	0·6	3·3	1·3

The results are interesting, but in considering them the remarkable durability given to fir timber by a proper process of creosoting, as shown by the examples of railway sleepers, must be borne in mind. The monograph of Mr. S. B. Boulton contributed to the Institution of Civil Engineers ("Proceedings," vol. lxxviii.) gives much valuable information on this subject. The fence of the Victoria Docks, which was erected in 1855, was made of creosoted Baltic fir, and is,—or at any rate was until recently,—perfectly sound and strong.

NOT much longer "they will talk of mad Shallow" at Clement's Inn, unless, haply, that fatuous Justice's memory shall survive the demolition of the present buildings in their entirety, for their site has been taken with a view to the erection of lofty blocks to serve as offices and as residential flats. Last week the panelling and garniture,

window-frames and roofing, were stripped from off the hall, which, together with the adjoining modern house, No. 11, is to be pulled down at once. Then Nos. 12 and 13, 14, 14A, and 15, and the pretty little garden-house will, as we are informed, be cleared away. The hall was lately occupied by the Monotype Printing Company; the east end (exterior) was repaired, it appears from an inscription thereon, in 1873. A view that is given in W. Herbert's "Antiquities of the Inns of Court and Chancery" (1804) shows it as forming the south side of the then Middle-square, and with a lantern or bell turret, since removed. The steps, too, have been re-arranged, and a stone balustrade substituted for the ground railing. An inscription under the curved (broken) pediment of the doorway stands thus :—

IMPENSIS HUJUS HOSPITII EXTRUCTA
ANNO MDCCXVI. I. BLACKWELL. P.

A gilt anchor with a shortened stock, which, with a C, is the cognisance of the parish and Inn,* appears on an ornamental tablet in the centre of the attic story; on a lower similar tablet is "Lex Anchora Regni." The new Bankruptcy offices that are now being built by the Office of Works,† in rear of King's College Hospital, quite overshadow the older and better-fashioned garden-house. It is said to have been built *temp.* Queen Anne. The third story is of a later date, and so, seemingly, are the casements and balconies. On the lawn, eastwards, over against Yeat's-court, rested the leaden figure of a negro, kneeling on his right knee, and holding over his head a sun-dial (bearing date "1731"), which the Earl of Clare presented to the Inn. The statue was purchased for twenty guineas in March, 1884,—when the pictures and other effects of the Inn were dispersed,—by Mr. William Holmes, who gave it to the Inner Temple, whereof Clement's Inn, with Lyon's and Clifford's Inns, had been an appendage. By a record quoted in Herbert's work, it appears that an Inn, or House, of Chancery existed on this same site in King Edward IV.'s reign. In the year 1486, Sir John Cantelowe, knight, gave an eighty years' lease of the property to William and John Elyot,—in trust, presumably, for students-at-law. Cantelowe's interest was acquired, *circa* 1528, by William Holles, Lord Mayor in 1539, an ancestor of John Holles, Earl of Clare, who demised the property to the then principal and fourteen ancients.

IT is stated in the *Daily News* that the interior of Bow Parish Church has just been restored, after the designs and under the direction of Sir A. W. Blomfield. The flooring is relaid with wooden blocks; encaustic tiles replace the flags in the chancel, aisles, and nave; and new pews are fitted; the interior has also been re-decorated. The church was originally built as a chapel-of-ease for Stepney parish, on license, it is stated, from Ralph of Baldock. He was Bishop of London during the interval 1306-13, upon a site taken out of the high road to the ancient bridge at Stratford across the river Lea. The bridge, rebuilt about fifty years ago, formed one of the probably politic benefactions to the citizens made by Mathilda of Scotland, consort to King Henry I., whence Stratford derived an agnomen that is perhaps now most familiar to us in Chaucer's description of the prioress in his "Canterbury Tales." In 1719 the chapel at Bow was consecrated for use as a parish church, with a dedication to St. Mary. Old Ford, a short distance above the stream, near to the outlet of Hackney brook, marks the situation of the, reputedly, earlier passage through the river into Essex; there stood a building known as "King John's palace," and mentioned in the "Beauties of England and Wales." West Ham Abbey and the Abbey Mills pumping-station (sewerage) take their name from the Cistercian Abbey of Stratford Langthorne, founded by William Montfichet, in 1134; within a mile south from Bow-bridge stood the St. Leonard's convent, in respect of whose antiquity the chroniclers do not agree. Dugdale ascribes it to the Conqueror's day. We read in "London in 1891" that a well-known match factory stands on the site of the Bow china factory, founded there in 1744, and removed in the next year to Derby.

* The supposed dedication of the church is to St Clement, reputedly the second bishop of Rome, whom Trajan caused to be flung into the sea, bound to an anchor.

† *Vide* article in the *Builder*, March 19, 1887.

THE last-issued number of the Journal of Proceedings of the Royal Society of Antiquaries of Ireland contained an article of considerable interest, by Mr. Thomas Drew, the well-known architect (and President of the Society), on the surroundings of St. Patrick's Cathedral, accompanied by a map plan of one cathedral and precincts as formerly existing, compiled from two plans of the last century and from the ordnance survey. In regard to the original intention of the founder, Mr. Drew thinks that "Comyn had it apparently in view to make his foundation popular, and, as he had example in England, as at Wells, to plant out his dignitaries in pleasant allotments round the Cathedral rather than in cloistral seclusion." Mr. Drew continues—

"It may be that he projected the cloister square, as at Wells, as part of this scheme, and that we may err in surmising that he found one there; but there are very definite indications of a usual Cistercian type of cloister plan, and we can lay down on the lines of modern maps the Domus Conversorum, Refectory, Fratry, Chapter-house, and, intervening between it and the south transept, actual record of the Prison in the usual place, surviving up to late times. However it may be, the Cloister-square was assigned to the Vicars Choral and the Archdeacon of Dublin. The former had their hall in the Fratry of the normal plan. There they remained, and were visited by the Archbishop of Dublin in the seventeenth century. Behind it to the east, and just in the usual place in a Cistercian monastic plan, were the 'Houses of Office,' maintained until a late day, and known by the queer nickname of *Ballygorran*. By it flowed the usual cleansing watercourse, which followed the line of Mitre-alley. If you draw a line from this across the Cathedral to Glendalough-lane you will find the line of this ancient watercourse resumed. The course of this stream suggests the eastern limit of the Irish Church of St. Patrick de Insula."

THE opening lecture of the session in connexion with the Classes in Architecture and Construction and Architectural Drawing at University College, London, will be delivered at the College on Monday next, the 5th inst., at 7·30 p.m. The subject is "New Departures in Architecture," and we understand the Professor will touch, among other things, upon the possible development of an English architecture that shall not be a copy of any pre-existing style, in the near future. Admission is free and without tickets.

OWING to absence from town for a few weeks, the attention of the Editor of this journal has only just been called to the following statement published in the September number of the small monthly periodical circulated among the members of the Architectural Association under the title of *A. A. Notes* :—

"We print elsewhere the letter which was kindly sent by Professor Aitchison to the Hon. Sec., with the intention that it should be inserted first in 'A. A. Notes' and afterwards in the *Builder*. Through a mistake it was forwarded to the *Builder* before the appearance of *A. A. Notes*, and consequently appeared first in that journal."

This statement is entirely misleading as to the facts, and appears to us to be very disingenuously worded. Professor Aitchison asked us to publish in our pages a letter which he intended to address to the Architectural Association, and asked us at first to publish it simultaneously, as near as possible, with its appearance in *A. A. Notes*. To this we objected, and Professor Aitchison then proposed that we should publish his letter first, leaving him the liberty to republish it in *A. A. Notes*, to which we assented, with the usual understanding in such a case that it should appear there as "reprinted from the *Builder*." That this latter condition has been overlooked is of no particular consequence; but the gentlemen who conduct *A. A. Notes* have no right to circulate among their members a statement as to a "mistake" which never existed in the sense obviously conveyed by the words; and as to what was "intended," we beg to remind them that our "intentions" go for something in the case, and we never had the slightest intention of entering into the arrangement which they describe.

LETTER FROM PARIS.

IN spite of its desire to simplify administrative machinery, the Government persists in its determination to retain the Direction des Beaux Arts. The candidature of M. Roger Ballu may be considered as abandoned; and M. Havard prefers his own studies to the doubtful honour of presiding over the undisciplined artistic world. There remain on the field M. Xavier Charmes, at present director at the Ministry of Public Instruction, and M. Lapommeraye, the theatrical critic, both well known to "tout Paris," one of whom will probably succeed M. Larroumet.

As we have already observed, the Conseil Supérieur des Beaux-Arts, following the lead of M. Bourgeois, the most liberal and reforming Minister we have had for some time at the head of the department of Public Instruction, has come to some important decisions in regard to the management of the Academy at Rome, the Museum funds, the question of instruction in art for women, and the manufactory of Sèvres: but it has avoided committing itself to any opinion on the general question of the administration of Fine Arts, a subject which will probably be much discussed next session. There is certainly much need for reform in a department which is quite behind the general standpoint of the day in our home politics. It is a curious thing to see, in Republican France, the State the director of institutions which in other countries enjoy entire liberty of action, the former intervention of the Government, which only arose from the desire of certain Sovereigns to play the part of Mæcenas, having been long since abandoned. It is generally understood now that Art is closely connected, or should be, with the daily work of life, and that it is more for the public good to leave it free development than to establish an academic culture. This liberal policy has a warm supporter in M. Antonin Proust, formerly a Minister of Arts, who intends to demand in Parliament next session somewhat the same modifications in artistic rule which Gambetta had already proposed in 1881. Gambetta considered that an administration of art ought not to multiply costly and unprofitable establishments, but to draw together on this subject the action of the Government, the Departments, the Communes, and the existing societies of artists. M. Proust, it is rumoured, intends to demand the suppression of the National Manufactory of Mosaic, the work of which he has already criticised. According to him, the ceiling of the grand staircase of the Louvre is one of the poorest productions of the day. This is perhaps rather sweeping, and M. Guillaume, who directed the work, is undoubtedly an accomplished artist; but no doubt this decoration is somewhat overpowering for its situation, and has a bad effect on some of the adjacent antique work.

At the Louvre (where the management might take example from the English National Gallery in regard to improvement in the arrangement and hanging of the pictures), various new works are being placed; some large bas-reliefs in the ground story, and in the Salle Campana the fine terra-cottas bought from the Gréau sale. Six fine Dutch paintings lent by M. Moreau have been placed in the Rubens Gallery, and in the antique galleries the public can now see the mosaic brought from Kabi-Hiram by M. Renan in 1863, and which, formerly laid in the pavement of the Byzantine church of St. Christophe, now forms four panels of very interesting work.

But the National Museums are always suffering misfortune. At Versailles the surveillance is so inadequate that an object of great value was removed the other day. At the Louvre the

workmen employed in the Grand Gallery have splashed over Rembrandt's picture, "The Walk to Emmaus," with spots of white paint. The cleaning of it has been undertaken, and some care taken to keep the other pictures out of harm's way: but it is certainly singular that in a State Museum the most ordinary precautions are not taken for the safety of the treasures they contain.

Parliament will shortly be in session again, and the Municipal Council also will recommence its labours. The inquiry will soon be commenced in regard to the tubular electric railway which M. Berlier has for three years past proposed to establish; a very needless inquiry, inasmuch as the authorities concerned have just seen an identical railway working quite satisfactorily in London. And if, when the members of the Municipality went to London to study the metropolitan railway question, they had visited the suburban districts, they might also have seen a rope railway working in a safe and satisfactory manner, while that at Belleville has so many mishaps that it has become proverbial. The metropolitan railway scheme itself has to be submitted to the Conseil Général des Ponts et Chaussées, and will not be finally submitted to the Chamber before November; and considering all the impending legal formalities, the realisation of the project seems still in the distance.

The right bank neighbourhood will shortly have an important new road, the Boulevard Raspail, commenced a long time since, and which, when completed, will unite the Place Denfert-Rochereau with the Boulevard St. Germain. The work is expected to be finished by the end of the year.

The opening of an additional wing to the Lycée Henri IV. is also announced as shortly to take place. The new building, situated on the Rue de l'Estrapade, behind the Panthéon, is to unite with the old buildings of the Abbaye St. Germain, partly re-built in the fourteenth and fifteenth centuries. This building, one of the most curious in old Paris, includes a lofty and fine tower, restored in 1885 by Ruprich-Robert. Few Parisians know the interior cloister of this Lycée and the ancient refectory of the monks, a work of the thirteenth century, which now serves as the chapel.

M. Yves Guyot has been taking a round among the "bâtiments civils" with which his department is concerned, in order to examine into the most urgent repairs and demand the necessary credit from the Chamber. He went the other day to Versailles, where, for want of funds, the architect in charge has confined himself to such repairs as are indispensable. He has also gone over the École des Sourds-Muets, the École Normale Supérieure, the Collège de France, the Museum of Natural History, and the Library of the Arsenal, in which the apartments of Sully are still preserved in their integrity. All these monuments have more or less need of repair and preservation against the further ravages of time. It remains to be seen if the Minister will be followed in his protecting mission by Parliament, which does not count many archæologists.

The month of September has been a fatal one in the artistic world, and to the list of deaths which have already been chronicled in another column of the *Builder* we must add that of the painter Narcisse Berchère. Berchère was born in 1819 at Étampes. A pupil of Renoux and of Charles Remond, he sent his first work to the Salon in 1844. In 1847 he visited Spain, and subsequently went to Egypt, Turkey, and Palestine. On his return he became, and remained to the end of his life, a painter of eastern landscape. Among his principal works are "Jacob's Well," "A View on the Nile," "A Mosque in Cairo," "The Simoom," "The Passage of the Red Sea by a Caravan," "Last Halt of a Caravan," &c. He was an author as well as an artist, and wrote two books entitled "The Desert of Suez" and "Five Months in the Isthmus."

Elie Delaunay, whom we have also lost, was the worthy rival of Cabanel as an artist, and very much superior as a man. Cabanel was a great artist who was thoroughly alive to his own merits, which he even exaggerated with a self-esteem almost as pronounced as that of Meissonier. Delaunay, on the contrary, was entirely given up to work and seemed to think little of himself and to wish to pass unperceived among the celebrities of his day. He was surrounded by attached friends, and his unexpected death caused great distress at the École des Beaux-Arts, where the young students adored him, at the Institute, and in the circle of his numerous friends. Born at Nantes in 1828, he first entered the atelier of Lamotte, then that of Hippolyte Flandrin, whom in his gentle and melancholy character he somewhat resembled. He obtained the Prix de Rome in 1856, and medals at various exhibitions; in 1878 was created officer of the Legion of Honour, and in 1879 became a member of the Institute. In 1859 he exhibited the "Leçon de Flûte," a very important first picture. Other important works by him were "Le Serment du Brutus," "La Communion des Apôtres" (now in the Luxembourg), and "La Peste de Rome" also in that museum, and one of his finest works. But it was in portraiture that he showed his highest qualities. His portraits of Bizet and Gounod, of the actor Regnier, of Général Mellinet, of the Archbishop of Sens, and of M. Henri Meilhac, are not likely to be forgotten. He was also an admirable water-colour artist, and the series of compositions for the fables of Lafontaine which he exhibited in 1866, showed his talents again in a new light. He also executed various decorative paintings in buildings at Nantes and at Paris, and his work is to be seen in the churches of St. François Xavier and La Trinité, and at the Paris Opera. Last summer he had accepted also a commission for a decorative painting for the grand staircase of the Hôtel de Ville.

In quite another order of art, Theodore Ribot was in his way one of the most powerful of contemporary French painters. He was born at Eure, in Bréteuil, in 1823, and commenced by painting signs and covers for books. After long privations heroically endured, he was at last, after many refusals, admitted into the Salon. His interiors "De Cuisine" and "De Basse-cour" were little to the taste of the public, but were much appreciated by various critics, especially Burger and Castagnary. Among his numerous works may be specially mentioned "Le Martyre de St. Sébastien," and "Le Bon Samaritain," both in the Luxembourg; "Un Cabaret Normand," "L'Huitre et les Plaideurs" (in the Caen Museum), "Le Supplice des Coins" (Museum of Rouen), "Les Marionettes au Village," and a remarkable series of still life paintings.

His pictures are found fault with, in spite of much vigour, for their tricks of lighting and the constant juxtaposition of strong black and strong white, the repetition of which becomes a mannerism. Ribot was an admirable water-colourist and an etcher of the first order, recalling in the latter art the hand of Rembrandt. Having declined, on account of his health, to execute the decoration of the ceiling of the Salle-à-Manger at the Hôtel de Ville, he received a commission from the Municipal Council for a picture representing a Mediæval scene, under the title "La Justice du Roi." Since the formation of the Champ de Mars Salon Ribot exhibited no more at the Champs Elysées. He leaves a daughter who is also a distinguished painter.

We have to note also the death of M. Lecœuvre, a distinguished engineer, formerly professor of mechanical construction at the Ecole Centrale, whose name is intimately connected with the popularisation of industrial machinery in France. During the siege of Paris, Lecœuvre, then Secretary of the Civil Engineering Committee, contributed largely to the improvement of the *matériel de guerre* required for the defence of Paris.

At the last moment we hear of the death of M. Lavastre, whose name will remain as a decorative artist. He was born at Nîmes in 1834, and came to Paris in 1854, studying under Despléchein, with whom he designed the decorations for "Hamlet," "Don Giovanni," "L'Africaine," and other operas. Many of the finest scenic effects to be seen in our theatres of late years were designed and contrived by him; and he also designed the ceiling decorations of the Opéra Comique (now burned) and the theatre of the Porte St. Martin. He contributed largely to the decoration of the Great Exhibition of 1889, and designed that of the central dome, for which he was awarded a gold medal and the cross of the legion of honour. He was a man at once modest and learned in his art, much liked by his assistants and artistic allies, and who worked with an assiduity which in fact shortened his life. He died almost, one may say, in the midst of his work, being occupied, in the midst of ill-health, almost to the last day, at his decorative work at the Galerie des Fêtes of the Hôtel de Ville.

THE RICHMOND MAIN SEWERAGE.

Since 1867, and even before, the disposal of the sewage of the Lower Thames Valley has been the subject of local proceedings, frequently of a costly nature, and much public discussion. The difficulty of Richmond itself was especially that, by reason of the extent of the Royal Parks and other Crown lands, no sufficiently eligible site for the erection of sanitary works for the purification of the sewage before its discharge into the Thames was obtainable within its own boundaries. During this long period there were various Committees and Boards, the most important of which was the Lower Thames Valley Main Sewerage Board, formed in 1875, whose duties extended over the districts of nine urban and two rural districts, including an area of forty square miles. After having expended 40,000*l.* with no practical results, it was, after eight or nine years' existence, abolished through the single-handed action of the Corporation of Kingston. In the year 1885 Mr. J. C. Melliss, M.Inst.C.E., proposed to the Richmond Vestry the formation of a joint board for the parishes of Richmond, Barnes, Mortlake, Kew, and Petersham, and submitted the plans which have now been brought to a successful termination. A joint committee was formed in 1886, which in the following year became the present Richmond Main Sewerage Board, of which Mr. Charles Burt, of Richmond, is the Chairman, and Sir John Whittaker Ellis, the Mayor of Richmond, and Mr. J. Whitcombe, Chairman of the Richmond Rural Sanitary Authority, *ex officio* members.

The details of the respective parishes are: Richmond, 1,210 acres; rateable value, 176,500*l.*; population, present time (1891), 22,684. The totals of the remaining four parishes are, area 3,773 acres; rateable value, 139,556*l.*; population, 18,864.

The local drainage of each is under the direct management of their respective local authorities; and the great and useful work of the Richmond Main Sewerage Board has been to connect the outlets through which all these parishes eject their sewage with main intercepting sewers, which convey the whole quantity to the new precipitation and purification works on the banks of the river at Mortlake, near to the confines of Kew.

The works were commenced in August, 1888, and occupy seven acres of a site of eleven acres, the remainder of the ground being reserved for future extensions when required. The cost of purchase of this site was 10,000*l.*, and a further sum of between 3,000*l.* and 4,000*l.* has been expended in acquiring a dock and other useful additions. This site is 2 ft. 6 in. below high-water at spring-tides; but embankments and other provisions have been made in respect to the tanks and buildings to save them from inundations. The main intercepting sewers are about five miles in length, and carry by gravitation the whole of the distance,—the invert of the pump-chamber being 43 ft. below the floor of the engine-house, and 25 ft. below Ordnance datum. The sizes of the sewers have been calculated to receive only a limited quantity of rainfall and subsoil water, the outfall sewer having a discharging capacity of eleven million gallons in the twenty-four hours, equal to the requirements of 50 per cent. more than the existing population. The present flow is estimated at $2\frac{1}{2}$ million gallons per day, and the wet weather flow at $5\frac{3}{4}$ million gallons. The diameters of the sewers—which are circular—vary from 15-inch socket-pipes to a 40-inch concrete and brick sewer of about 500 yards in length. Their gradients vary from 1 in 250 for the smallest to 1 in 1,200 for the largest. Ventilation is provided by Holman-Keeling patent sewer-gas destructors, and by connexion with the chimney-shaft of the pumping-station. These serve to exhaust foul air, and the open gratings in the manhole covers will consequently act as fresh-air inlets. The sewers have been almost entirely carried through the London clay below the gravel of the district.

The new works comprise a straining-chamber, a pump-chamber and pump-house, an engine-room, boiler-house and coal-store, chemical-stores and mixing-houses, press-house and sludge-chamber, and various workshops and stores, stables, and cart-houses. Within the principal edifice is a large board-room, and adjoining it a compact office for the Engineer. There are eleven precipitation tanks, together holding 1,210,000 gallons; and one-and-a-half acres of filtering-beds.

Besides the above, the grounds are well laid out;

and provided with tramways in communication between the buildings and the dock and wharf. There is a pretty cottage for the foreman and four others for the workmen employed. The machinery consists of three sets of plunger-pumps for lifting the sewage, and three 50-h.p. compound horizontal condensing engines for working them, by Simpson, with three Galloway's 18 ft. boilers; a pair of 14-h.p. vertical engines for mixing chemicals, driving tools, and the like; a Worthington steam-pump for drawing water for the boilers; and a pair of large Worthington steam-pumps for use in case at any time a continuance of high tide and flood in the Thames should prevent the discharge of the effluent water by gravitation. Three Johnson's patent presses, containing thirty plates each, are employed in producing portable and inoffensive sludge cakes, 3 ft. square by 1½ in. thick, to the extent of about 10 tons per day, and which can be sold or stored according to demand.

The process of purification and precipitation adopted is first an admixture of lime-water, and after this a further admixture with the Porous Carbon Company's patent "Alfesil"—a compound of porous carbon made from the shales of the Devonshire lignite beds, sulphate of alumina, sulphate of iron, and some soluble silica. This porous carbon is also a large ingredient in the filter-beds, which, in addition, have a spreading of vegetable soil and are grassed over on the surface. The effluent which comes away is perfectly inodorous, and as limpid and clear as spring water itself. Its purity is far above the prescribed formula of the Conservancy Commissioners.

The total cost of the works is over 115,000*l.* The annual expense is estimated at 3,500*l.*, and this, together with repayment of capital and the interest thereon, will not, it is expected, exceed a rate of 7½d. in the pound for the entire cost.

The works were publicly opened on Monday last by the Right Hon. C. T. Ritchie, M.P., President of the Local Government Board, in the presence of the chairman and members of the Richmond Main Sewerage Board and a large number of visitors, who took great interest in the works, which have been designed and carried out in exceptionally good style and workmanship.

COMPETITIONS.

Public Baths for Lambeth.—We are informed that upon the recommendation of their arbitrator (Mr. Henry Currey) the first premium in this competition has been awarded to Mr. A. Hessell Tiltman by the Commissioners of Baths and Washhouses for Lambeth, for his design submitted in competition for their new Westminster Bridge-road establisbment.

Public Baths, Shrewsbury.—The Shrewsbury Town Council met on the 28th ult., the Mayor presiding. The principal business was the selection of a plan for the new public baths from a number of designs which were sent in. Alderman Lloyd, Chairman of the Baths Committee, proposed the adoption of the Committee's recommendation that the design marked "Plan" be accepted as the best, and that marked "Naiad" as the second, the premiums offered of 50*l.* and 20*l.* to be awarded respectively to Mr. J. Johnson, Queen Victoria-street, London, and Messrs. Horton & Co., Wednesbury. Alderman Lloyd said the Committee would have been glad had the best design been one by a local gentleman, but as it was he believed they would have one of the best baths they could possibly get. The motion was agreed to.

Castle Donington Sewerage. — The Shardlow Guardians lately advertised an open competition for the best scheme for the sewerage and sewage disposal of Castle Donington. Mr. W. H. Radford, C.E., of Nottingham, has just been awarded the first premium, and a Vestry meeting of the ratepayers will shortly be held to consider the desirability of carrying out the scheme at once. The population is about 2,500, and it is proposed to deliver the sewage by gravitation on to ten acres of suitable land, where it will be purified by irrigation. The storm-water from roads will not be admitted to the sewers. Part of the outfall sewer will consist of an iron pipe-syphon 750 yards long. The cost of the engineering works is estimated at 2,300*l.*

Sheffield Municipal Buildings.—It has now been arranged that the foundation-stone of these buildings is to be laid on the 9th inst. by the Mayor.

THE KING'S CROSS TUNNEL.

The new tunnel just north of the Great Northern Railway terminus at King's Cross is approaching completion. It is a remarkable example of engineering, not only on account of the difficulties under which it has had to be accomplished, in consequence of the busy traffic daily carried on, but also by reason of the successful introduction of a very useful novelty in the mode of driving the tunnel itself. The Regent's Canal crosses the end of the station so closely, that all the passenger traffic of the Great Northern line, and of the Southern and Metropolitan railways in communication with it, has to dive into the earth below, alike for arrival and departure trains. To make the gradients as easy as possible is a primary consideration with the engineer. There already exist two lines of tunnels; but additional relief being required, a third is being added on the western side.

It is about 530 yards in length, and passes under numerous lines of rails and turntables, and under the long goods-shed and the potato market, as well as under the canal. The work was begun in May last year (1890), by the contractor, Mr. Lovatt, of Wolverhampton, and has proceeded without any intermittence under the contractor's engineer, Mr. Prouse, and Mr. Duncan, the resident engineer for Mr. Richard Johnson, the engineer-in-chief of the Great Northern Railway. The crown of the tunnel is, in some places, as near the surface as 5 ft. 6 in. But, notwithstanding this shallow covering, the tunnelling has been effectually accomplished by means of steel "needles," as they are technically called—an invention of Mr. Jennings, a practical miner, and used for the first time on railway work of this class in the present instance. These "needles" are steel bars 10 ft. long, 6 in. broad, and 2 in. thick. They are rolled to a section, which permits an interlocking or sort of open hinge along the sides and which holds them together in position. The bars were originally rolled to the section fig. 1. But, on the suggestion of

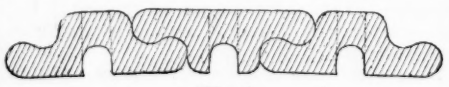


Fig. 1.

Mr. Duncan, the section shown in fig. 2 was adopted for that portion of the tunnel which is driven under the buildings. The new tunnel

Fig. 2.

has been worked from six faces. To start working with the "needles," a short open cutting was made, and a length of 18 ft. of the tunnel completed within it. Two series of "needles" were then laid over this length of tunnel arch; one set overhanging in one direction and the other set in the opposite direction. The respective faces were then driven onward by the miners. We will follow one for succintness of description,—the others are worked in exactly the same manner. When the miner has driven into the soil to form a top heading, the "needles" are drawn forward close to the roof of the excavation, until he has got out sufficient for a 6-ft. length of brickwork. These "needles" are supported at one end by the brick arch, over which they have just been drawn, and at the other end by timber "horse-heads" cut to the contour of the tunnel; these "horse-heads" being supported by, in the first instance, raking props, and afterwards, when the top cill has been got into place, by props from this cill.

The way the "needles" are drawn forward is by inserting a pin in one of the many holes with which the length of the needle is perforated, and pushing it forward by means of a powerful screw-jack between the pin and the brickwork of the tunnel. When the miner has worked his driftway sufficiently forward, the roof is cleared away on each side, and more of the needles are, as before, drawn forward as the excavations proceed, thus always forming a protecting roof overhead. To prevent any sinking of the ground above, when the needles are drawn from the brickwork of the first length, the outer ring of the tunnel arch beneath the needles is built as in fig. 3; and when the needles have been drawn forward 2 ft., fine Portland cement concrete is rammed in the openings thus formed, and, by means of the screw-jack, is squeezed over the blocks of brickwork left between these openings so that the roof of the tunnel is properly supported in its place. The needles are then

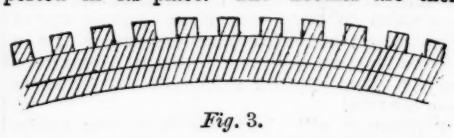


Fig. 3.

advanced another 2 ft., and concrete again inserted, and so on until the whole of the needles are taken forward. These needles are only used for about 12 ft. on each side of the centre of the roof of the tunnel, the remainder of the excavation being supported by timber bars and polling boards in the usual way.

When the miners have worked out the excavations for a length of tunnel, the bricklayers put in the inverts and side walls, after which timber ribs of the form of the upper portion of the tunnel are placed in position, and the bricklayers then build the arch by first placing a lagging or plank across the ribs, and then laying bricks in cement for the full thickness of the tunnel arch, as far as this lagging will allow. Then another lagging and another layer of bricks, and so on, building close up to the needles until that portion of the crown of the arch called the key is reached. The laggings on each side of this portion of the tunnel have a rebate formed on one edge to support what are technically called "block laggings;" and it is upon these that the bricklayer forms the "key," working, in this instance, from the last length of brickwork towards the face of the excavation until the whole 6-ft. length of tunnel is completed. Another drift-way is then worked forward by the miners, and the crown series of needles drawn forward as before, and supported by the timbering of the face at their foremost ends.

As the various portions are cut away, the face of the tunnel is secured and stayed by timbering with polling boards, props, and cills in the usual way. In this manner the bricklayers succeed the miners, and the miners the bricklayers, without cessation night and day, except on Sundays. Thus the work goes on until the needles, which were put in at the commencement of the tunnelling, are withdrawn at the finish so little worn by the operation, that they are fit for any other tunnel in another place. The advantages of the needles are that they are very inexpensive, compared with the ordinary timbering, a considerable portion of which has often to be left in the ground; that in a tunnel like the present the needles only occupy 2 inches of vertical space, instead of 2 ft. as the ordinary timbering would do; and that they can practically accomplish by tunnelling work that which otherwise would have to be done by open cutting—a most serious impediment to railway, street, and road traffic.

The King's Cross tunnel is very flat in its form, being 26 ft. across and 22 ft. in vertical

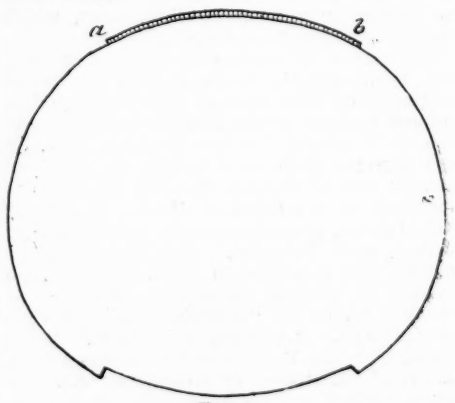


Fig. 4.

height. Fig. 4 gives a section, and also from *a* to *b* shows the layer of needles forming the supporting roof over the excavation for the arch.

"Mongewell, on the Thames."—Messrs. T. Lawrence & Sons ask us to mention that this house, which was illustrated by us last week, was built with bricks supplied from their works, and they object to the description of the facings as "red clamp bricks, as the bricks used there were "the very best class of kiln-burnt red facing bricks." The short description we published was (as usual in such cases) supplied by the architect of the building.

INCORPORATED ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS:

MEETING IN DUBLIN.

The Incorporated Association of Municipal and County Engineers visited Dublin for the first time last week, with a view not only of seeing the works of some of their Irish *confrères*, but also to bring the claims of the Association more prominently before Irish Borough and County Engineers.

On the first day, Friday, September 25, there was an excursion to the Vartry Waterworks, which supply Dublin. The party, numbering altogether between thirty and forty, started from Harcourt-street Station at nine o'clock, and was accompanied by the City Engineer, Mr. Spencer Harty, and by the Assistant City Engineer, Mr. James Andrews. Bray was reached shortly after half-past nine, and here a number of brakes and outside-cars awaited the arrival of the members. The brakes were driven through Sir Robert Hodson's demesne, "Hollybrook," then through the village of Kilmacanogue, the Glen of the Downs, passing by the side of the Sugar Loaf, Kilpeddor, and Newtownmountkennedy. The first stoppage was at the measuring weir at Callow Hill, through which the entire water supply of the city flows, and where the tunnel through which the water passes from the filtering beds at Vartry Lodge, a distance of 4,346 yards, ends. The members remained here for a considerable time, and listened with much interest to the history given by Mr. Harty and by Mr. Andrews of the adoption in the year '63 of the Vartry supply by the Corporation, or rather by the Waterworks Committee, and of the subsequent carrying out of the works. The party at one o'clock resumed the journey, and a little before two arrived at the Lodge, where luncheon was prepared. After luncheon the works were inspected, and great interest was taken in the working of the machinery which is employed for washing the sand, gravel, and stones used for the purposes of filtration. Special interest was added to the visit by reason of the fact that the men are at present engaged in removing, for the purpose of being cleansed, the entire bed of one of the filter reservoirs. Of the ten filter beds, a thin stratum of the sand is removed from two each week for the same purpose, but until this year (according to the *Freeman's Journal*, to which we are indebted for this part of our report) it has not been thought necessary to remove the whole of the bed, which is 6 ft. 9 in. in depth, and which consists of 3 ft. of fine sand, 6 in. of fine gravel, 6 in. of ordinary gravel, 9 in. of round gravel, and 10 ft. of large stones. The process of filtration is downward. Already the beds of three of the filters have been removed, washed, and replaced, and in time the remaining ones will be similarly treated. The beds were originally laid in '67, when the works were completed. The party spent an hour and a half in the works, and at four o'clock returned to Bray by way of the Rocky Valley, and Dublin was reached at half-past six o'clock. The party included Messrs. T. de C. Meade, President; E. Pritchard, M. S. Gaulter, P. C. Cowan, A. L. Davis, E. A. Hackett, J. O. Moynan, J. Robinson, R. E. Dubbin, J. P. Norrington, W. J. Scoones, J. Marchant, H. Royle, J. T. Hawkins, W. G. Forden, J. Parker, R. H. Dorman, Chas. Mason, F. J. Edge, T. L. Lewis, J. C. Radford, J. Wilson, W. G. Eams, Robert Godfrey, J. Hill, Peter Burtchaell, Henry V. Whitt, J. T. Eayrs, Spencer Harty, City Engineer; Jas. Andrews, Assistant ditto; R. A. Gray, Wm. Weaver, C. H. Lowe, J. T. Butland, J. Pelditch, C. W. Mayne, F. Griffith, W. H. Simpson, Henry Richards, W. H. Leete, Henry F. Marks, W. H. Smith, W. H. Savage, P. Dodd, Thos. B. French, F. Morrie, and Thomas Cole, Secretary.

In the evening the members dined together at the Hammam Hotel.

On Saturday, the 26th, the members assembled in the City Hall, the President, Mr. T. de Courcy Meade, in the chair.

The President, in opening the proceedings, said:—Perhaps, as this is our first meeting in Ireland, it would be well if I should briefly call your attention to the objects for which this Association was formed. It was formed some twenty years ago, and three years ago it was incorporated, when the scope of the Association was extended considerably. County Surveyors and other engineers, who were not originally included in those eligible for membership, were admitted, and now, I am pleased to say, the numbers have extended, and the interest felt in the work of the Association has extended not only through Great Britain and Ireland, but we have also members in India, in China, in America,—and, indeed, I might say in all parts of the world. The Association was brought together first by a few Municipal Engineers who felt the want of some body in order to give them an opportunity of meeting together and interchanging opinions, and discussing such subjects as were of interest to Municipal and County Engineers. Municipal and County Engineers were very important officers in their respective districts. The Municipal Engineer, unlike the medical officer who tries to cure after the disease has broken out, struggles to prevent the diseases to which we are so liable from bad sanitation, inferior water supply, and other troubles we have to contend with in our towns, and he has, I am pleased to say, so far succeeded during the last twenty or thirty years that the death-rate in Ireland and England has been materially reduced. As an Irishman, I recollect passing through Dublin for the first time twenty-five years ago, and then it was a city very different from what it is to-day. The pavements then were not of the best, and I was pleased to note that a great change had taken place when, ten or eleven years ago, I visited the city. I was still more pleased when, this week, I saw the still more important improvements. The hurried visit we pay this time to Dublin will prevent the members who have not been here before from seeing one-tenth of what is to be seen in this ancient and interesting city, but I hope that this, our first visit to old Ireland may be one of many happy and instructive visits which we may pay to this country.

Mr. Spencer Harty, the City Engineer of Dublin, then read a paper on "Sanitary and other Works carried out by the Corporation of Dublin." In commencing it he said:—

The object in the writer's mind is to give the Association, on their visit to Ireland, as graphic an account as possible of the sanitary and other works carried out by the present Corporation of Dublin, who, with the limited means placed at their disposal, have within the last thirty years so much improved the city that it now can compare favourably with the best-regulated cities in the British Empire. Unfortunately, Dublin is not a manufacturing city, and portions of the old city are going into decay; but yet, like the phœnix, it seems to again rise out of its ashes, other portions springing up and taking the place of those going into decay. The valuation of the city was made many years ago, and the rates are still struck on this old valuation, which in most cases averages only from one-half to two-thirds of the rent of the houses; accordingly the rates seem high in proportion. The city is also surrounded by townships with independent control, and to a stranger it would be impossible to say where the city ends and the township begins; not one of these townships would be in existence but for the city, and they are dependent on the latter for their support. It is late in the day for such divisions now; all should be united and placed under one joint board of control and government, who would work together in harmony for the general good, and so equalise the rates.

Having given an interesting historical sketch of the sanitary condition of Dublin, Mr. Harty proceeded thus to speak of

The Water Supply.—I will now proceed to give you a brief description of the present water supply to the City of Dublin, the originating of the site being due to Mr. Richard Hassard, a Dublin engineer at present residing in London, but the works were carried out by the late City Engineer, Mr. Neville, with whom I as well as others, were assistants.

The Vartry stream rises at the base of the Sugarloaf Mountain (on its southern side), in the County of Wicklow, at an altitude of about 1050 ft. over Ordnance datum, and flows from north to south a distance of five miles to the commencement of the impounding reservoir, situate under the village of Roundwood, passing altogether through pastoral lands. On its route to the reservoir it receives the addition of tributaries, some of which are larger than the main stream itself. The geological formation of the ground is the Cambrian and Lower Silurian.

The water is pure soft water, very much akin to that of Lough Katrine, the degree of hardness being about 1·600 before boiling,—Lough Katrine being about 1·900. A recent chemical analysis by our Medical Officer of Health, Sir Charles Cameron, gives the following result:—

An Imperial gallon (70,000 grains) contained:—

Total solid matters	.. .. ..	4220 grains.
Including:—Albuminoid ammonia	..	0·006 grain.
Free ammonia	.. ..	0·001 ,,
Nitrogen in nitrates and nitrites	.. .. ..	Trace.
Phosphoric acid	.. ..	Faint trace.
Chlorine	.. .. ..	0·995 grain.

Oxygen absorbed from permanganate of potassium solution—

After fifteen minutes at 80° F.....0·058 grain.
After four hours.....0·159 grain.

The colour of the water, when looked at in a tube two feet long, was clear, slight yellow; no smell. When water was heated, it exhaled no odour. . . .

The work commenced in the year 1862, by forming a large embankment to impound the river and flood the lands to a level of 692·50 over datum, the top bank being 698·50. The area of the ground under water is 409 acres, the by-wash or overflow weir 300 ft. long; the cubical contents of water in the reservoir at this level is 2,374,358,344 gallons, but means have since been adopted to raise the height of water 12 in., by stop planks fixed on the top of weir, which has the effect of increasing the quantity by nearly 109 million gallons.

A tunnel is built in the rock under the embankment, having a solid plugging (on the water face) of Staffordshire blue firebrick set in cement, 38 ft. thick; through this is carried two main pipes, the one being 33 in. diameter for the supply, and the other 48 in. for purposes of running water into old bed of river below the works in case of any necessity to do so.

The water can be taken into this 33-in. main from different levels in the reservoir, according as it rises or falls, so as to enable it to be brought on to the filters as pure as possible (inlets being fixed at 683·03, 672·80, and 662·60), and from thence it passes on through feeders or goits on to the filter-beds, now ten in number, and which are constructed in the usual manner, having 6 ft. 6 in. of filtering material, composed of sand, gravel, and broken stones; the system adopted being downward filtration. The area of the water on the filters is about 24,480 square yards for the entire number, which will easily filter, according to usual formula, about 17¼ million gallons per day.

Until last year, in maintaining and keeping the filters clean, the usual custom was to scrape off the top layer of dirty sand from each filter as it required attention, and then turn on the water again, this process being continued until the sand was worn out, and the filter required a complete renewing of fresh sand.

This scraping off of the dirty sand from the filter requires only about two days for eight men. The filters in winter are each able to work from five to eight weeks, and in a dry summer, if the water gets very low in the reservoir, for about four weeks, without requiring any attention or cleaning, the head of water varying accordingly from 2 ft. to 3 ft.

On an average, from 150 to 200 tons new sand is used each year in the ordinary course of cleaning, so that a similar quantity must be lost in the washing and from other causes. The cost of cleaning out 3 ft. of sand on top, washing and restoring, labour and material, is about 66*l.*

Last year, for the first time since the works were completed, I commenced to have the filters entirely cleaned down, including the dry rubble drains in the bottom; the materials thoroughly washed, and the sides concreted. This is a troublesome and expensive process, but it is well worth so doing, as the water comes off the filters thus treated infinitely purer than from those treated in the former manner; they also filter more rapidly than before, and the three now done are able to make up for an additional filter working short (as the two processes are going on), without having to increase the head of water on any of the other filters.

It took fifteen men eighteen weeks to clean out and entirely renew one of these filters, at a cost of about 208*l.*, including horse hire, &c.

When all are complete, the work will really prove a saving, and the filtration being more rapid, the filters will do more work, as well as do it better than before. Taking the quantity of filtered water passing over Callowhill weir as 14,000,000 gallons per day, the cost of "labour" for maintenance at impounding reservoir and for filtering is equal to about $\frac{1}{16}$d. per 1,000 gallons. . . . .

From the filters the water passes on to two pure water tanks (both filters and pure water tanks are uncovered), from whence it is conveyed through an iron pipe 820 yards long joined to a tunnel 6 ft. by 5 ft. (egg-shaped), 4,332 yds. long, having a fall of 4 ft. per mile; the water emerges from this tunnel at Callowhill, where it flows over two 10 ft. weirs into a circular basin 86 ft. in diameter and 10 ft. deep; the level of the water in tank is 602. From this point it is carried by a single line of 33-in. diameter pipes, having a hydraulic gradient of 20 ft. per mile to the service reservoirs in Stillorgan (three in number). Between Callowhill and Stillorgan there are three relief tanks, where the pressure is broken, these tanks are—

Kilmurry	473 ft.	over datum.
Kilcrony.....	414	„ „
Rathmichael	441	„ „

The top water in the service reservoir at Stillorgan stands at 271 ft. and 274 ft., respectively, for the upper and lower reservoirs, and the Gray Reservoir, when full, at 274, the total contents being as nearly as possible 166,000,000 gallons.

When the works were first visited, as much as 20,000,000 gallons per day were sent down over the Callowhill Weir,—now the quantity is much less, which is due to oxidation in the pipes, the soft water acting on the cast-iron, creating a number of nodules of oxides of iron on the interior, which not only have decreased the delivering capacity of the pipes, but have also seriously increased the friction. A proposition is now before the Corporation to lay a second line of main from Callowhill, so as to maintain a proper supply of water to the various districts. From Stillorgan the water is brought into the city in two 27-in. diameter pipes, connected at intervals on the route, so that a section can temporarily be shut off for repairs, and one main feed the two. At the city boundary (Leeson-street Bridge) a pressure-gauge station is placed, where the pressure on the mains, both on the city and county side of valve is hourly recorded day and night. From this point the mains bifurcate, the one continuing on in a northerly direction, the other going eastwards and northwards, until both meet again at the extreme of the northern side of the city, thus creating a ring, and forming a main artery from which all other mains and services are fed, and which are again all joined into each other with valves on each end of every street, so that supplies can be taken from any point. Bateman and Moore pattern ball hydrants are fixed on the curb of footpaths at regular intervals of 100 yards. All the large mains are lead-jointed, but from and including 18 in. and downwards they are turned and bored, the taper being 1 in 32. These joints have practically never given any trouble, the 18 in. especially, not one of which ever leaked. . . . .

The entire district supplied, including city, townships, and extra municipal districts, contains an average area of about 40 square miles, all of which is supplied with water from the 33-in. main under the main embankment at Roundwood, only 3¾ turns of the valve being open out of a total of 40 turns, the full number which it takes to open the valve.

Each township pays the Corporation a certain fixed rate on its valuation for the water supply, but the supply to the rural districts is in the hands of the Corporation.

The entire cost of the works up to date has been 660,000*l.*, which is equal to about 1*l.* 17s. per head on the gross population supplied, taking the population of rural districts at 20,000.

The charge for water for domestic purposes to the inhabitants in the city is a rate of 4d. in the pound, and 3d. for public water rate, making a total of 7d. in the pound on the Government valuation.

Water for trade purposes is charged at the rate of 6d. per 1,000 gallons, and for small supplies which it is difficult to measure separately from the domestic, a charge of 20s. per annum is made.

Sewers and Drainage.—There are something close on 100 miles of sewers in Dublin, 76 of which have been entirely newly built by the present Corporation, the remainder being old ones re-modelled, renewed, and underpinned; all the new brick sewers are egg-shaped, and the old have been newly inverted. The sewage at present all gravitates to the Liffey, where it is discharged, all the outlets being well within the city boundary.

Although most of the sewers have good falls and are properly constructed, so as to be self-cleansing, in a great many instances it is found that such is not the case,—partly caused by the scavenging labourers sweeping the mud, &c., down into the gullies, and private drains being made use of for the purpose of getting rid of ashes and all sorts of house refuse. This is a difficult matter to deal with, as it is almost impossible in either case to get at the delinquents; nevertheless, it is not only a source of trouble and annoyance but also of expense. There is no automatic flushing to any of the Dublin sewers, the course adopted being to flush periodically by means of a hose worked from one of the street hydrants.

For many years the question of taking the sewage out of the river has been agitating the public mind, and in 1870 a scheme was promoted before Parliament, and for which an Act was passed, to convey the sewage out to the North Bull, a distance of about four miles from the city boundary, and there discharge it into the bay at certain states of the tide. Plans were got up for this work and estimates obtained, but the amounts were so much in advance of the estimates that the work was withdrawn, and the scheme remodelled; but even this latter was withdrawn. Subsequently it was proposed to get up a scheme of precipitation, the works to be constructed on the slob lands at Annesley Bridge, immediately adjoining the city boundary; however, nothing has been done, and the Act has been allowed to lapse.

The question has now again been brought forward, and the Corporation are at present deliberating on what course to pursue. Undoubtedly, so far as Dublin is concerned, that proper course would be to discharge the sewage at once into deep sea, if a suitable outfall can be obtained at a comparatively reasonable outlay.

Sewage is essentially a nuisance, and as such should be got rid of in the most expeditious manner possible; if this outfall cannot be obtained, and within reasonable limits as to cost, then the Corporation must fall back on precipitation; but this latter will be troublesome so far as the sludge is concerned, as I fear Dublin farmers are not likely to trouble themselves much about taking it. The question then will arise as to how to dispose of it, and must another barge be built to remove compressed sludge cakes by dropping them into the sea? As for making a profit (as some say) out of sewage treated chemically and otherwise, I fear it is more an object to be desired than as yet accomplished.

I regret at a meeting like this that I am unable to go more fully into this subject, but as it is still *sub judice* I am unable to do so.

In connexion with the sewers, however, is the drainage of houses, without proper attention to which a city cannot be healthy; unfortunately, however, this matter has heretofore been most negligently attended to, and, in order to try and provide a remedy in future, clauses were inserted in our Act of last year providing that where any dwelling-house is drained only by a built or brick drain, the house shall be deemed to be without a drain sufficient for effectual drainage within the meaning of the Public Health Act. Power of entry has been obtained to test for sewer gas.

Under a penalty of 20*l.*, no new house after being built can be occupied unless nor until the City Surveyor has certified its fitness, and under a similar penalty no new house can be occupied in a new street until the part in which such house is built shall have been properly paved, sewered, and lighted, &c. These sections are absolutely moves in the right direction. Since the Act was passed (now just twelve months), several applications have been made by occupiers to test the drains for sewer gas, &c., and otherwise as to proper construction, and in no case, I am sorry to say, has such been found in anything approaching to good order; the result being that notices have to be served, and orders obtained to put the drains into a proper state.

Difficulty is found in enforcing the Act in regard to a certain class of builders in the city, as naturally they evade, if possible, having the drains thoroughly overhauled and tested, which they must be before I issue my certificate.

Ultimately this procedure must have a very marked effect on certain diseases, especially those of an enteric type.

In connexion with the drainage of houses, plumbers and plumbing work steps in, especially where there are water-closets (Dublin is now entirely a water-closeted city); and it is of the highest importance for the welfare of a city that none but highly skilled men should be employed in work of this character, and that the young artisan should be properly trained in all the details of plumbing and drainage, and taught what are the effects of bad work on the public health.

We have in Dublin a Plumbers' Registration Association, in connexion with the London Guild of Plumbers, who have an excellent school for night classes, where the young apprentice is taught the details of his business—a most important adjunct to the master's shop, and undoubtedly a gain to the masters, as the young men who attend such classes must prove more valuable to them.

Artisans' Dwellings.—The Corporation have not been unmindful of the Acts for providing better dwellings for the working classes, as they have cleared two sites, and let the ground to the company entitled the Artisans' Dwelling Company.

On the Coombe area the cost of clearance and rebuilding amounted to 52,000*l.*, and on the Plunket-street area the cost was 46,245*l.* There are four classes of houses built on this latter.

	£.	s.	d.		s.	d.	
No. 1 cost	64	0	0	and is let at	2	6	weekly.
„ 2 „	75	0	0	„	4	0	„
„ 3 „	80	10	0	„	4	6	„
„ 4 „	114	10	0	„	6	0	„

Benburb-street buildings have been built by the Corporation at a cost of 27,500*l.*; they contain 144 tenements let at weekly rents varying from 1s. 6d. to 5s.; and at Bow-lane forty-three two-storied houses have been similarly built by the Corporation, containing eighty-six tenancies, with rents varying from 2s. to 5s. 6d.

Baths and Wash-houses.—Baths and wash-houses have been built in Tara-street at a cost of 14,000*l.* They contain a first-class swimming-bath, 57 ft. by 33 ft., and second-class, 64 ft. by 26 ft., which contain 45,000 and 40,000 gallons of water respectively, and, in addition, there are thirty-six reclining-baths, eight being for women; there is a laundry and wash-house in addition, which is largely patronised. The space at the disposal of the Corporation was small, and consequently a portion of the work is rather cramped; but the baths are largely availed of by the parties for whose benefit they were intended.

New Streets, &c.—Besides the new streets made and opened up for the purposes of artisans' dwellings, others have been made—notably Lord Edward-street at a cost of 69,000*l.*, and Tara-street at a cost of 19,800*l.*, and two others at a cost of 17,000*l.*

The Corporation also subscribe grants annually out of the rates to various hospitals, reformatories, and lunatic asylums, the amount for this year being 33,797*l.*, the grant for the Richmond asylum alone being 13,797*l.*, although the patients are brought there from all parts of Ireland, and until last year the Corporation had no voice in the management.

In the remainder of his paper, Mr. Harty treated of markets, abattoirs, open spaces, public libraries, and public electric lighting, a large installation of which is now being carried out by the Corporation.

Mr. R. H. Dorman, County Surveyor of Armagh, followed with a paper on "Road Maintenance."

The papers having been discussed, and votes of thanks passed to the authors, the meeting terminated. Having visited several places of interest in the afternoon, the members were entertained at dinner at the Mansion House by the Lord Mayor of Dublin.

Congress of Hygiene.—In our issue of September 5 we made a brief reference, in our report of the discussion on the papers on "Isolation Hospitals," to a passing discussion between Mr. Richard Weaver and Dr. Thorne Thorne in regard to what we alluded to as a "nostrum" of the former gentleman, the use of which would dispense with the necessity for "Isolation Hospitals." It appears that Mr. Weaver considers himself deeply aggrieved by the use of the word "nostrum," which is no doubt often used in a derogatory sense, but does not necessarily bear such a sense, and was in this instance used with the most innocent intention, merely as the most convenient word that came to hand. However, we will consider the word "nostrum" withdrawn, and substitute "specific," which we trust is a harmless word.

ARCHITECTURAL ASSOCIATION VACATION VISITS:

"POLES," NEAR WARE.

THE last vacation visit of this year took place on Saturday, when a party of the members, under the direction of Mr. F. M. Elgood, paid a visit to "Poles," the new mansion now nearly completed for Mr. E. S. Hanbury, from the designs of Messrs. Ernest George & Peto. The house is situated about a mile and a-half from the town of Ware, in a park containing a goodly number of fine old trees, and skirting the main road to Buntingford.

Entering the house by the principal entrance, we have the great hall on the right, and parallel to it the drawing-room. Beyond the hall, and looking into it, is the principal staircase, with the billiard-room and library. On the left of the principal entrance is the dining-room, business-room, and the domestic offices. Internally the chief expenditure has been upon the hall, which is panelled in darkened oak, with a considerable amount of carving by Knox. A very good effect is obtained by the contrast of the stonework, which is here, and generally throughout the house, shown internally as well as externally, and is a warm-coloured Ham Hill stone. An archaic effect is also obtained by the floor-joists, which are oak, of the rooms above being left exposed. To prevent the sound passing through, the flooring of these rooms consists of a double layer of floor-boards, with plugging in between. The principal staircase is also liberally treated with solid carved oak newels, the treads being solid spandril steps of oak, and consequently very pleasant to mount. The drawing-room has an elaborate coved plaster ceiling, the effect of which will probably be very good when finished.

Compared with the hall, staircase, and the drawing-room, the remainder of the interior of the house is comparatively plain, the effect of the upper rooms especially being to a certain extent spoilt in the opinion of the visitors by the mantel-pieces, which were *not* designed by Mr. Ernest George. It is somewhat amusing to see some old deal skirtings re-used in the upper part of the house. One of the pleasant features of the house is an open gallery next to the school-room, which is both pleasant to look at and a useful contrivance for giving the children the benefit of the fresh air.

The exterior is carried out in red brick with diapers of a purplish-grey brick, and dressings of Hamhill stone. The phase of old work on which Mr. Ernest George has based this design is seventeenth-century architecture of a more English type than is seen in some of his designs. A somewhat unusual effect is produced on the garden front by the bay-windows being arranged between the gables, instead of beneath them, as ordinary people do. The house, which is really very long on plan, has been carefully grouped with a strongly projecting wing containing the dining-room, to prevent it from looking thin, as a long type of house sometimes does.

Before leaving, the visitors partook of Mr. Hanbury's hospitality, while the ride home was brightened by a fine sunset.

THE LONDON COUNTY COUNCIL.

THE London County Council resumed its sittings, after the summer recess, on Tuesday afternoon last, Sir John Lubbock, the Chairman, presiding.

Impending Resignation of the Chairman.—The Chairman, at the opening of the proceedings, said that, as the Council were aware, the Chairman and Vice-Chairman, under the Act passed last session, remained in office until next March. He, however, proposed to place his resignation in the hands of the Clerk (Mr. De la Hooke) at the close of next month. This he proposed to do partly on private grounds, but he also felt that it was necessary for the dignity of the Council and for the proper conduct of its business that its Chairman should hold his office not by virtue of any technical right, but by the wish and with the support of his colleagues. They had always maintained that their duties were those of a municipality rather than of a County Council, and in other municipalities, except under special circumstances, it was considered desirable that the office should be annual.

Sir Thomas Farrer, the Vice-Chairman, intimated that he should adopt the same course as that indicated by Sir John Lubbock, and for the same reasons.

Proposed Street Improvements.—The Improvements again Committee brought up a report recommending the Council to carry out most of the street improvements recommended in their report of July 8 last, which has already appeared *in extenso* in the *Builder*. The proposed street from Holborn to the Strand was, however, omitted from the present recommendations of the Committee, although the Committee say that they feel "that this is one of those which should be undertaken at the earliest moment which the Council's finance will admit of." The first recommendation brought up was as to what is known as the Sandy's-row to Bishopsgate Improvement. As to this the Committee now reported:—

"The Council, when considering our report on July 28 last, made an exception in favour of this improvement, and specially postponed the consideration of it until the first meeting after the recess. The new thoroughfare is intended to accommodate the increasing traffic from the north-west to the Docks, but it is rendered still more necessary by the construction of the Tower Bridge. We may mention incidentally that it will improve a densely populated and insalubrious locality, which the Housing, &c., Committee has expressed great anxiety should be dealt with. The formal recommendation is as follows—

'That powers be sought in the next session of Parliament to enable the Council, at its own cost, to widen Sandy's-row to 40 ft., between Middlesex-street and No. 23, Sandy's-row, and that, subject to the City Commissioners of Sewers agreeing to undertake the continuation of the thoroughfare, 40 ft. wide, from this point to Bishopsgate, as shown upon the plan submitted herewith, and subject to an estimate being submitted to the Council to the Finance Committee as required by the statute, the Council do contribute one-half of the entire net cost of the City portion of the improvement.'"

Mr. Henry Clarke, the Chairman of the Committee, moved the adoption of this recommendation, pointing out that the proposed improvement would not only form part of the northern approach to the Tower Bridge, but would be of great importance from a sanitary point of view.

Mr. Hubbard moved, as an amendment,—

"That, whilst agreeing with the Committee as to the desirability of carrying out the improvements, the Council, feeling the great injustice of placing the whole cost of such improvements on the occupiers, who in most parishes are already heavily rated, declines to apply to Parliament for power to carry out any further improvements except where it would be detrimental to health and life not to do so, until Parliament has given the Council power to raise at least half the cost of such improvements by a rate levied on the ground landlords, who reap the benefits of such improvements, or by some other means, so that the whole burden shall not fall upon the occupier."

After a long discussion, the amendment was rejected on a show of hands by 38 votes against to 30 for it, and subsequently, on a division, by 44 votes against to 35 for,—a majority of 9 against.

After another amendment had been moved and defeated, the recommendation of the Committee was agreed to, but owning to the advanced hour, consideration of the other recommendations of the Committee's report had to be adjourned.

After transacting other business, the Council adjourned.

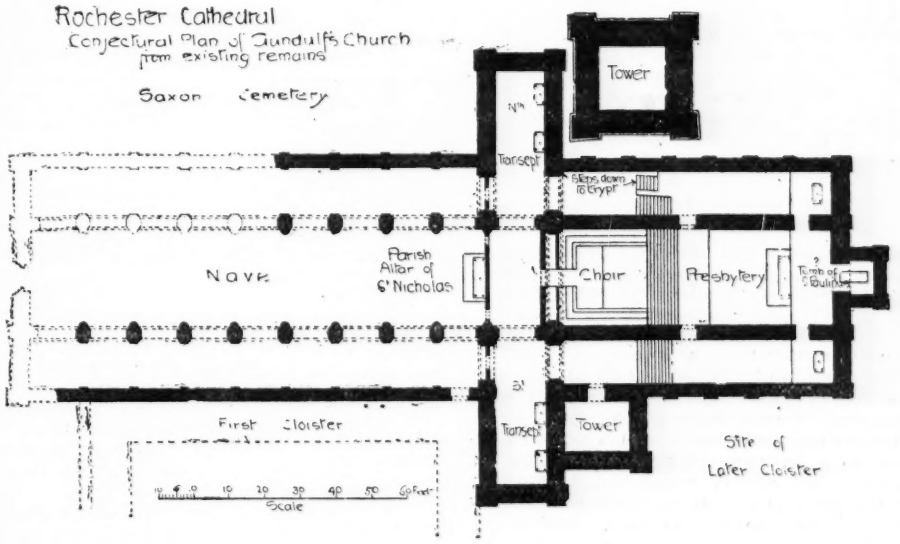
Illustrations.

ROCHESTER CATHEDRAL CHURCH.*

THE Cathedral Church of Rochester is situated a little eastward of the Castle, almost under the shadow of Archbishop William's mighty keep, and about midway between the High-street and the old southern line of the City wall. The first church that occupied the site was built, apparently of stone, by Æthelbert, King of West Kent, in 604, and dedicated in honour of St. Andrew. It stood just to the west of, and partly under, the present church, and the foundations of its eastern apse were found in 1888 during the underpinning of the west front.† Its plan and extent westwards have not, however, been traced.

The old church seems to have survived the various ravages of the Danes, but by the time of the Norman Conquest it had fallen into decay. It was, therefore, pulled down by Bishop Gundulf, who built a new church to the east of it, and replaced the secular canons whom he found in possession by a convent of Benedictine monks.

The new church consisted of a presbytery and choir, both with aisles, six bays long; a very narrow transept; and a nave and aisles (left incomplete) of nine bays. The presbytery and its aisles were square-ended, with a small square chapel projecting from the centre of the front, and both presbytery and aisles stood over a crypt of four bays. There was no central tower, but in the angle formed by the north transept and choir stood a massive detached campanile, built by Gundulf, probably as a defensive work, before he began his new church. Much of it still remains. On the south side of Gundulf's church, in the angle east of the transept, was a corresponding tower, but of lesser size and closely connected with the main building. This was removed in the thirteenth century.

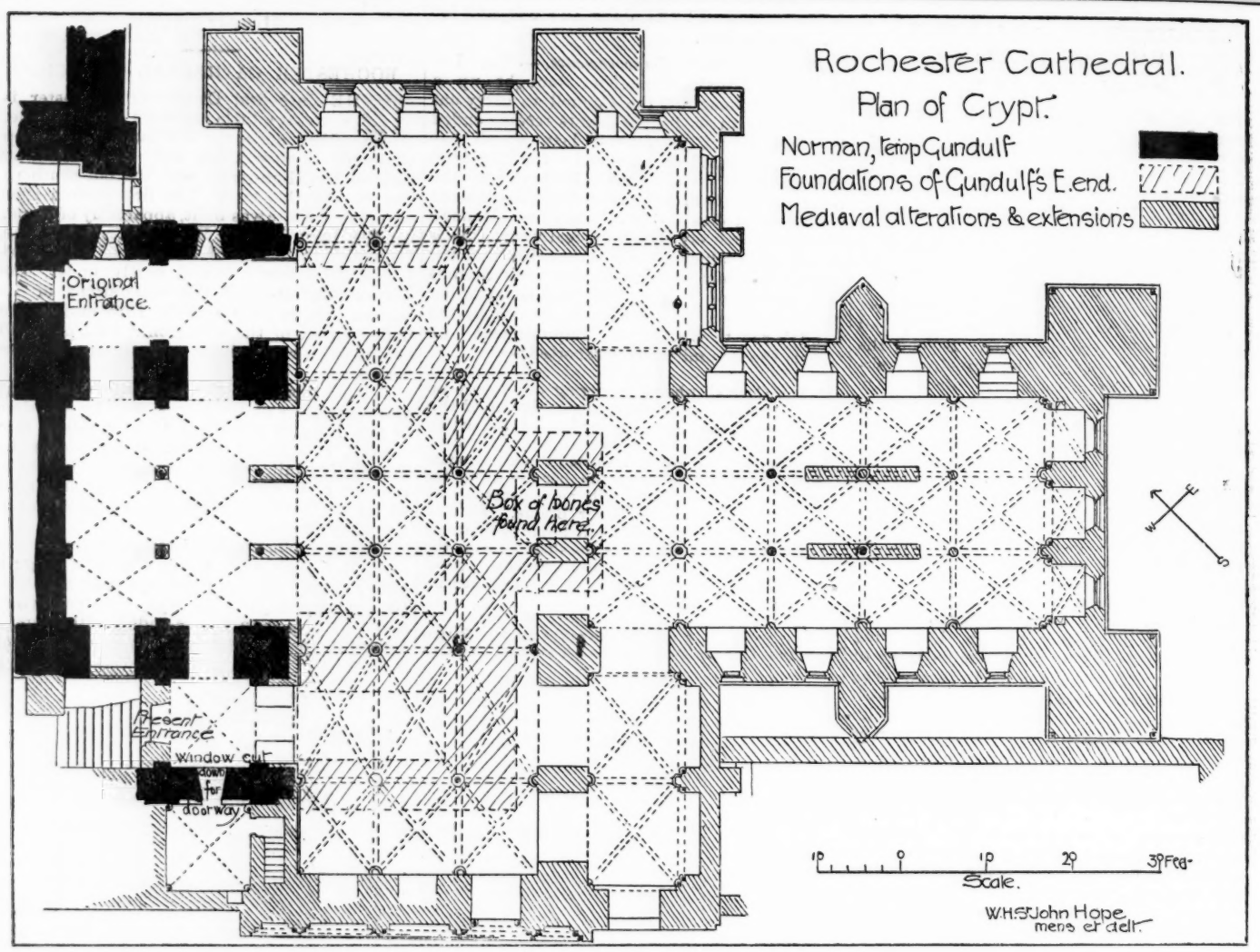


Of Gundulf's work we can still trace five arches of the south arcade of the nave, but recased on the nave side; five bays of the south and three of the north wall of the nave as high as the window sills; the great north tower (in ruins); the western half of his crypt; and probably the main part of the choir walls.

The nave, which was the parish church of St. Nicholas, had been left incomplete by Gundulf, probably on that very account, but from indications found during the recent underpinning some attempt seems to have been made to finish it. About 1115, however, the nave appears to have been taken boldly in hand by Bishop Ernulf, and given much its present form. But the west front and the diapers filling in the heads of the triforium openings

* We may mention that this series of illustrations of the Cathedrals of England and Wales commenced with Canterbury, which appeared in the *Builder* for January 3 last. Since that date, the following Cathedrals have been illustrated, viz., Lichfield, in the number for February 7; St. Albans (before the alterations of recent years), March 7; Peterborough, April 4; Wells, May 2; Exeter, June 6; Salisbury, July 4; Bristol, August 1; and Norwich, September 5. The eleventh of the series; viz., Lincoln, will appear in the *Builder* for November 7 next.

† See an excellent paper by the Rev. G. M. Livett, in "Archæologia Cantiana," vol. xviii.



are a little later, though done in continuation of the other work. Whatever alterations were also made in the choir and presbytery have disappeared through later rebuildings.

About the end of the twelfth century, subsequent to a fire that took place in 1179, the reconstruction of the crossing and transepts and the building of a central tower were begun. These works were, however, temporarily abandoned, and instead the eastern part of the church was taken in hand.

The works were carried out by prior Ralph de Ros and his successor Helias, and included a spacious eastern transept and a new presbytery of more than twice the length of the old one. The new work was built up around the Norman east end, and when it was sufficiently advanced the eastern half of the old presbytery and the part of the crypt under it were taken down. The new building was then finished,* together with an extensive crypt beneath it, which was joined to the western half of the old crypt. The Norman choir, which had up to this time been used for the monks' services, was now altered to harmonise with the new presbytery, where the services were temporarily carried on. The work included the eastern piers of the new central tower, with the arch above them and the bay of the transept immediately adjacent on either side. The new choir, which was first used in 1227, was built by William de Hoo, sacrist (who became prior in 1239), out of the offerings at the tomb of St. William, a Perth baker, who was murdered outside the city of Rochester in 1201, when on a pilgrimage to the Holy Land, and canonised in 1256. With the widening of the south choir aisle and the partial rebuilding of the north aisle, the reconstruction of the monks' half of the church was complete, and in 1240 it was formally consecrated by the Bishops of Rochester and Bangor.

Shortly after the completion of the new choir the north transept was taken in hand and finished, together with the north-west tower pier.

Owing, probably, to lack of funds, the rebuilding of the south transept and the carrying-up of the new tower clear of the roofs were not completed till the end of the thirteenth century. The reconstruction of the nave was also begun, but abandoned after two bays had been altered.

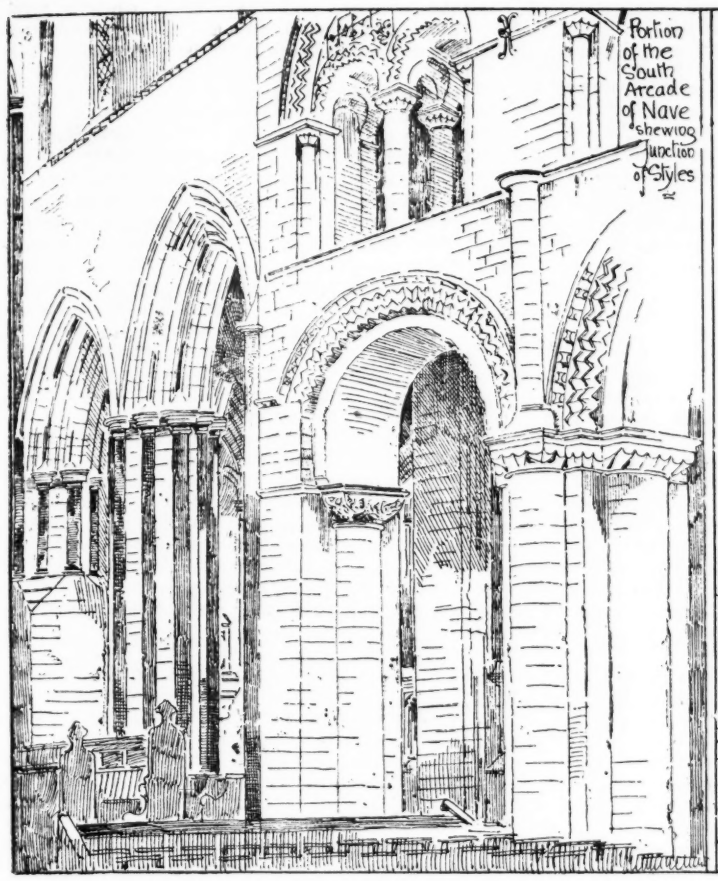
In 1343 the central tower was raised and capped by a wooden spire by Bishop Hamo de Heythe, who also placed four bells therein. The only other important works of the Decorated period were the side windows of the presbytery, the door and lower walls of the chapter-room, and the upper part of the south choir aisle. In 1423 the altar of St. Nicholas was removed from the nave into a new church built for the citizens in the graveyard called "Green Church Haw" on the north of the cathedral church. During the fifteenth century the clearstory and vault of the north choir aisle were built, and new windows inserted in the nave aisles. The Norman clearstory of the nave was also taken down and rebuilt in the prevailing style, the north pinnacle of the gable replaced by an octagonal turret, and the large west window inserted. The still later extension westward of the south transept, which was the Lady Chapel, by the building of a nave, completed the chief alterations and additions made to the church before the suppression of the Benedictine monks and refoundation of the secular canons.

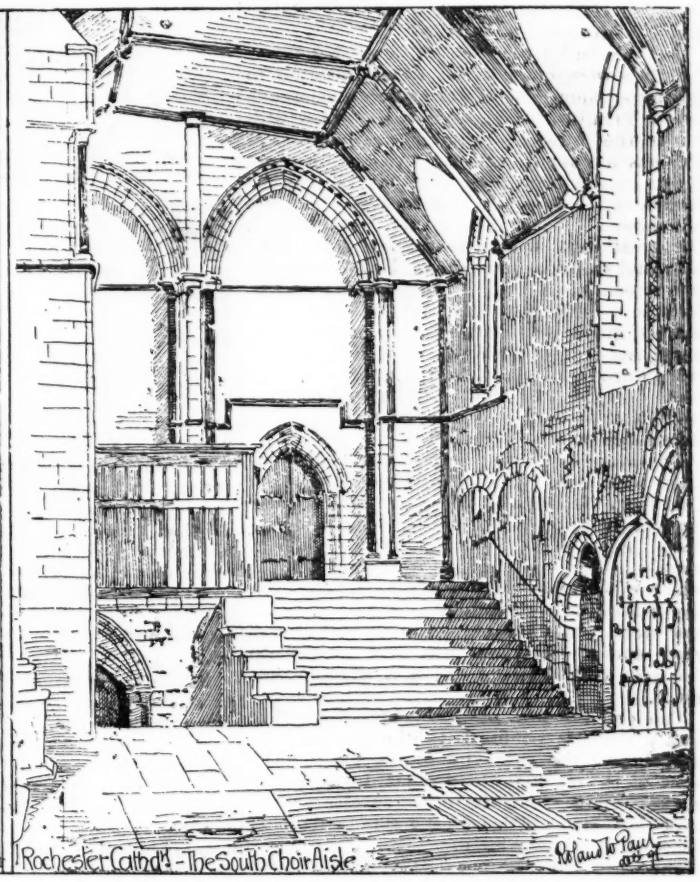
In 1664 the south aisle of the nave was recased, and four years later the north aisle was partly rebuilt. In 1749 Hamo de Heythe's addition to the tower was also rebuilt, and in 1763 the bad state of the west front necessitated the lowering of the southern turret and the entire rebuilding of the north turret. In 1826 and following years large sums were spent in repairs under the direction of Mr. Cottingham, who also pulled down the spire and recased and raised the tower as we now see it. A more conservative reparation was begun in 1871 by Sir Gilbert Scott, who thoroughly repaired the whole of the church east of the nave. The repair of the west front, which had to be left for lack of funds, is now being carried out by Mr. J. L. Pearson.

Externally, the church is uninteresting, and its appearance is not enhanced by Cottingham's poor tower and Scott's roofless gables. The west front retains much of its original Norman work, though in so bad a state that a good deal of the facing must be renewed. There is no need, however, for the repairs to include the adding a new head to the mutilated figure of our Lord in the tympanum of the great door, nor ought the unique images of Henry I. and his consort on the jambs to be ruined by giving them new faces. Yet we hear such mischief has actually been suggested! It is also proposed to replace the octagonal pinnacle of the gable, though a curious specimen of fifteenth-century restoration, by a "Norman" copy of the southern pinnacle.

Internally, though not remarkable for beauty, the church is an extremely instructive example of the growth of old buildings and of the way in which the old men altered them from time to time to suit their tastes and needs. The chief feature of the nave is the rich Norman work of the arcades and triforium; but the Perpendicular clearstory and roof are of very ordinary character. Of the Decorated work only two arches on each side remain. The east end of the nave has an unfinished look through the shafts of the tower arch being stopped off at some height from the floor. This was on account of the existence here of a solid stone screen or rood-loft against which, until 1423, stood the parish altar of St. Nicholas. The south transept was built at first to hold two altars, but early in the fourteenth-century the altar recesses were converted into one, and the transept became the Lady Chapel. Behind the altar recess is a small vestry. The north transept contains a single altar recess. Both transepts are vaulted, the north with stone, the south with wood. Of the same date as the south transept vault is the curious lop-sided wooden roof of the south choir aisle. The north choir aisle contains the tomb ascribed to Bishop Hamo de Heythe, and opposite it the mutilated memorial of William Streaton, nine times Mayor of Rochester, who died in 1609. Under the tower is a flight of ten steps, on which stands the *pulpitum* or choir screen. Its Early Decorated front has been recently enriched with canopied images as a memorial to the late Dean Scott. The south choir aisle is twice as wide as its fellow, and has assumed its present proportions by a very curious series of changes too long to describe here. It contains two pairs of stairs, one leading down to the crypt, the other to the upper church. At the head of the crypt stair, under

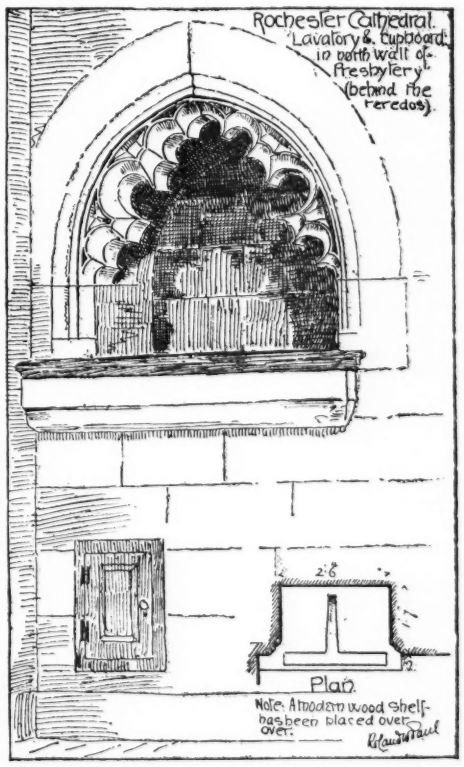
* Its completion was sufficiently advanced to allow of the burial in it in 1214 of Bishop Gilbert de Glanville.





a singular canopy, is a mutilated effigy ascribed to Bishop John de Bradfield. The crypt is both lofty and spacious. The two bays beneath the eastern half of the choir are Bishop Gundulf's work. The crypt contained at least six altars, and some interesting remains of paintings may yet be traced on the walls and vaults. The crypt is at present little better than a mere lumber-place.

The choir is remarkable, not only for the architectural treatment of its unpierced walls, but also as retaining *in situ* remains of the earliest choir fittings in this country. The stalls and misericords are almost entirely new, but the low benches in front, with much of their original colouring, are those put in when the choir was first used in 1227. The singular low desks escaped destruction through being encased, when the choir was refitted in 1541, by the Tudor panelling now forming the choir book-desks. Of the same date as the stalls is the eastern side of the *pulpitum*. The flat wall surfaces above the stalls are covered with an heraldic diaper of lions and fleurs-de-lis, in part fourteenth century, but chiefly a good modern copy of the original. Opposite the bishop's seat is the greater part of a wall-painting representing the Wheel of Fortune. The eastern transept and presbytery are not remarkable architecturally, and the general effect is greatly marred by the abuse of clumsy marble shafts. In the centre of the north transept, between the tombs of Bishop Walter de Merton on the north, and Bishop Lowe on the south (since moved), stood the shrine or tomb of St. William of Perth. An interesting marble coffin of a prior also remains against the north wall. The south transept contains a fine door of Decorated date, with figures of the Christian and Jewish Churches and the four Doctors. During Mr. Cottingham's repairs, the mutilated female figure of the Christian Church was "restored" by giving it a *bearded bishop's* head! The presbytery contains some good tombs. On the north side is the beautiful effigy of Bishop John de Sheppey, with its very perfect original colouring; a curious tomb ascribed to Bishop Glanville, with mitred heads in medallions; and a fine marble effigy of Bishop Laurence de St. Martin. Opposite Bishop Laurence's figure is that of Bishop Thomas de Ingoldesthorpe, the work, apparently, of the same "marbler." The three sedilia are poor Late Perpendicular. Behind the high altar, which stands against a top-heavy reredos designed by Sir G. G. Scott, is the casement of a large brass of Sir William Arundel, K.G., Governor of the Castle and City of Rochester, who died in 1400, and of his wife Agnes, whose hand he held. In the north wall is a curious lavatory recess, with a little smoke-cupboard beneath it.


Rochester Cathedral.
Lavatory & Cupboard in north wall of Presbytery (behind the Reredos)
2'6"
Plan
Note. A modern wood shelf has been placed over.

The whole of the stained glass in the church is modern, and some day we hope will be replaced by better. The present custom of disfiguring the walls with huge brass plates below the windows might be discontinued with advantage.

Of the conventual buildings some interesting remains exist. The first cloister was built by Gundulf on the south side of the nave, but it was afterwards removed to the south side of the presbytery, where Bishop Ernulf built a chapter-house, dorter and frater. The shell of the chapter-house, which was a very fine room, still remains, as does the basement of Ernulf's dorter. The frater retains a fine door, with groined lavatory and towel recess, the work of Prior Helias, about 1215. Of the western range only a Late Perpendicular porch is left. Three late gateways of the Precinct have also escaped demolition.

W. H. St. John Hope.

The following are the chief dimensions of the cathedral:—

Total length of church.....	305 ft. 6 in.
Length of choir and presbytery	147 ft. 6 in.
Length of great transept.....	120 ft.
Length of choir transept	88 ft.
Width of choir	28 ft.

The plan of the Saxon apse shown on the large ground-plan is from measurements made by the Rev. Grevile M. Livett in 1889, to illustrate his paper in the "Archæologia Cantiana."

CHOIR STALLS, ST. ALBAN'S CHURCH, TEDDINGTON.

This drawing shows the stalls that are intended to fill one bay on each side of the chancel. There will be two rows of seats in front of these for the men and boys of the choir. The whole of the work is to be executed in oak.

The drawing from which our illustration is reproduced was exhibited in this year's Royal Academy Exhibition.

MORTON CHURCH.

The church at Morton, which is to be consecrated this Saturday, October 3, is all new except the tower. But it owes its form to its having grown out of an earlier building, in much the same way that most of our old parish churches have done.

The first church at Morton was built in 1845. It was a fairly good specimen of the church building of the time, and consisted of a nave 55 ft. by 24 ft. 6 in. inside, with a tower at the west end, and a small chancel (not intended for use as chancels are now used) at the east. Some years ago an attempt was made to fit up the chancel for the use of a choir, but it was so inconvenient that it was determined to build a new chancel, and, as the church was smaller than the needs of the parish required, it was proposed at the same time to increase the accommodation by lengthening the nave eastwards. In working out the plan difficulties as to old graves had to be met, and this led to a considerable extension of the building southwards whilst it was confined to the north, and transepts of unequal length were added to the new part of the nave. The old nave ruled the width and height of the new work, but when it was partly built it was determined to have a new nave with aisles, so that nothing but the tower now remains of the original work. The whole rebuilding has been done without

stopping the Sunday services, or much interfering with those on week days.

As the building grew, gifts of handsome furniture were offered, and it was resolved to make the church, as far as possible, complete in its furniture and decorations whilst still under the direction of the architects, and this has almost been done. All the furniture shown on the plan is there in oak, besides the lecterns and other movable articles which are not shown. The chancel screen has above it the great rood, with attendant images as of old; and the side altar is fenced by a wrought-iron screen, given since the plan was made. The font is a large and fine one, of Frosterley marble, made by Messrs. Farmer & Brindley, who have also supplied the several figures of stone introduced in the work. A tall cover has been designed for the font, but is not yet made, and it is the only piece of furniture that the church lacks.

The windows of the chancel and chapel are filled with glass painted by Messrs. Morris & Co., from designs by Mr. Burne-Jones, and more is being prepared for the transept windows. Some of this glass takes the place of some bad memorial windows in the old church, which were taken away under the faculty, and the change is recorded by inscriptions in the new work. Another old window, which was good enough to keep, has been moved to the west end, where there is a window that fits it.

The ceilings are painted everywhere, but ornate work is confined to the chancel, the chapel, and the east end of the nave. The front of the organ is also decorated with painting and gilding, but the other furniture is of dark oak. Some little painting may be done on the walls when they are dry.

The altars have the usual ornaments of good sort, and most of them specially designed, and the church is well furnished with carpets and hangings of various sorts. Some of these are intended for occasional use, and it is hoped that they may be accepted as "decoration," and so save the church from damage and disfigurement from the nailing up of the trash which commonly usurps that name.

The architects of the church are Messrs. J. T. Micklethwaite & Somers Clarke, and it has been built by Mr. S. F. Halliday, of Stamford, who has also supplied the oak pewing of the nave. The other wood furniture and the carving are by Mr. J. E. Knox, of Kennington. Messrs. Powell Bros., of London and Lincoln, have done the painting. Mr. J. Shelmerdine has served as clerk of works from the first to the last. J. T. M.

ISLIP CHURCH, NORTHAMPTONSHIRE.

This is one of the most charming village churches in the county. Originally a Decorated building, it was entirely remodelled in the fifteenth century. The lower part of the tower and the aisle walls belong to the earlier period, but the upper part of the tower and spire are Perpendicular, together with the nave, arcade, and clearstory, the chancel, the south porch, and the aisle windows.

The nave is short and broad, and the chancel, long in proportion to its width, is one of the prettiest little chancels I have ever seen. It has a fine east end, of broad proportions, with good angle buttresses, and a fine east window. The chancel roof, of oak with heavy carved principals, or rather beams, is good.

The spire is graceful, and coming to it from Raunds, as I did, one is forced to the impression of how enormously the later Gothic architects had advanced their art, if in this one direction alone.

The porch is a gem, though exception may be taken to the too great size of the caps in the doorway. There is a charming little niche over the arch, with a canopy which runs up into a shaft, crossing the parapet, and terminating in the gable-cross.

The details of the church are very subtle, especially in the nave arcade, where the form of the piers is peculiar,—a narrow strip of masonry placed transversely, with attached shafts east and west; and the way in which this blends with the arch-mould after passing the capital is very good. The church is in good preservation, having been recently carefully restored.

On the whole, a more charming study of detail and of proportion and scale alike, than this church, it would be hard to find.

John Begg.

Books.

"*The Electrician*" *Primers*, being a series of helpful primers on electrical subjects for the use of students and general readers. Vol. I., Theory; Vol. II., Practice. London. "*The Electrician*" Printing and Publishing Company, Limited, 1891.

It would be impossible in the space of some 280 pages, many of which are occupied by advertisements or illustrations, to give more than a sketch of "the present state of electrical knowledge," and the authors of these primers have on the whole fairly fulfilled their promise of giving such a sketch in "simple and correct language."

In papers, however, specially addressed to beginners and artisans, accuracy is of the utmost importance, and these two little volumes, excellent as they are, would have gained much in value had they been carefully revised by a competent editor before publication. In that case, we should not read on page 23 that "The *work* done is measured by the product of the current and the pressure"; or, again on the same page, "The useful work done in this case is fifty watts." The student is, it is true, set right on this point on page 59, where he will find, "The watt is a unit of power, not of energy."

Similarly the author of Primer 6 corrects the false impression respecting polarisation which might be gathered from Primer 4, thus affording a second illustration of the advantage of multiplicity of authorship.

Some of the errors we have noticed are merely slips of the pen, thus in No. 37 cathode is three times printed where it is clear that anode is meant (by the way, we should be glad to hear from No. 37,—we hope he will pardon this mode of addressing him,—what potassium bitrate may be; we can only conjecture that it is a mordant salt), and in No. 10, "the standard ohm is a *column of mercury* of 1 square millimètre cross section and . . . ." (the italics are ours).

But there are other more serious errors; in No. 27 we find ". . . . in a motor the current causes the armature to rotate, and the electromotive force generated opposes the passage of the current. This may be understood by analogy with a windmill. In the ordinary working of such a mill, rotation is caused by a wind blowing *against* the face of the sails; if we now suppose the mill to be revolved in its normal direction by mechanical means it will act like a fan, and will cause the current of air to flow *away from* the face of the sails, *i.e.*, in a direction opposed to that of a wind which would make it revolve the same way. Hence, when a windmill rotates, it tends to stop the wind which causes the rotation." Comment is needless.

The statement in No. 26, that "this process of self-excitation goes on until, in consequence of the saturation of the magnets, they refuse to take up any more magnetism, and a limit is reached," would lead one to suppose that a dynamo is necessarily worked with saturated fields. The expression "amount of turning" is rather a loose one; if it be used in the sense of the angle of rotation, it is certainly incorrect to say that it is a measure of the current in a Siemens' dynamometer; it is a measure of the square of the current; this is the only error of importance in No. 12, though it is possible that a beginner might infer from the last sentence on p. 79 that the same instrument might be used either as an ammeter or as a voltmeter.

As further instances of looseness of expression we may quote from p. 4:—"That it is a property of changing currents to cause similar currents to flow in neighbouring conductors." (How similar?) And from p. 3:—"Magnetic force is remarkable . . . . because of its curious direction. No other force is known which acts at right angles to the direction of the agent causing it." What is the direction of an agent? We imagine in the case of a marine engine it may be taken as the direction of the piston stroke, and this is usually in a vertical plane perpendicular to the direction of the ship's motion. Again, the force one magnetic pole exerts on another *is* in the direction of the line joining them.

Of measuring impedance by ohms we will say nothing, we are aware that our author has high authority for his view, and *we* also (see preface) wish to avoid "theoretical discussion;" we turn with relief to the delightful "bull" on p. 256. "Hence the values usually given to the pressure and the current when a given number of horse-powers are to be transmitted are a mean between what is theoretically best and what is practically possible." *O si sic omnia!* Such blunders as this can do no possible harm, and they contribute to the gaiety of nations.

After this, the account of the carbon used in batteries as "a very dense kind of coke found in gas retorts, and known as gas carbon, or a similar material artificially manufactured" sounds quite commonplace, though it would be interesting to hear Mr. Ruskin's opinion of a man so saturated with nineteenth century civilisation that he regards gas carbon as a natural product.

The style of these primers is for the most part simple and lucid, but we could well dispense with such obvious blemishes as "is any different from;" or "effected considerably quicker and somewhat cheaper."

The authors have also well kept their undertaking that the matter shall be up to date and "the illustrations refer to instruments and machinery in actual use at the present time." The only exception is in No. 22, where the style is curiously involved, and the system of duplex telegraphy explained is one that has long been superseded. (The diagram gives one a hint of its great age in that the established conventional symbol for a cell | | is here reversed, the short line being made the positive pole.) It is but fair to add that the writer seems quite aware of this defect; but we will let him speak for himself in his own inimitable style:—

"The actual method when working duplex differs from the description in many details, but the object here is to explain the principle in a manner without using technical expressions, by comparing the current to something which will produce force, and to show how this force is made to divide itself at the sending station so as to become inoperative there; that when it arrives at the receiving end it is there placed in a condition to perform work."

Haworth's Practical Timber Measurer. By Alfred Haworth. Liverpool: Printed and published by the author at "The Timber Merchant" Office, 19, South John-street,

The author of this little book expresses in the preface a firm opinion that it is "greatly needed," and claims for it superiority over "ready reckoners and other similar useful publications." In only one respect, however, does it differ from an ordinary ready reckoner. It is compiled on the assumption that its readers are not equipped with the knowledge of arithmetic possessed by a school boy in the sixth standard, and supplies a number of rules—which the author incorrectly terms principles—in the hope of enabling them, while dispensing with this knowledge, to make calculations of the quantity, value, and weight of timber. It need hardly be said that the processes set out are cumbrous and sometimes inexact. Indeed the time that would be wasted in using them during two months would more than suffice a person of ordinary intelligence to learn enough arithmetic to do without them.

We quote the first rule in full:—"How to get the superficial contents (the number of square feet) of any board or plank. Always multiply the length by the width and divide the product by twelve, taking no notice of the thickness." Could anything be more slipshod? Unless one of the two dimensions multiplied together be in feet and the other in inches the result must be wrong; yet this is not stated in the rule. Again, who ever *would* take any notice of thickness in calculating a superficial area? Similarly, we have elsewhere "a square always consists of 100 ft. superficial, irrespective of thickness of wood"!

In measuring round timber we are told to ascertain the girth, to divide this by 4, and then to consider the stick as a square log whose sides are of this dimension. This rule involves the astounding proposition that the area of a circle equals the square of one-fourth of its circumference! Some one appears to have told the writer that this would not do, for in a note he remarks, "Theorists maintain that to obtain the measurement of round timber in the way here recommended gives the contents some 20 per cent. under what they should be." This is really unfair to the theorists. Surely if they are anywhere to hold a seat in this distracted globe it must be in the realm of pure mathematics. The writer is, however, on safer ground

when he "strongly advises every buyer to purchase round timber by this system of measurement, which, if not strictly accurate, has by custom rightly become established."

The book contains one or two useful tables: *e.g.*, one giving the recognised weights of various woods per standard, rough and planed; and another the number of feet (lineal and superficial) of timber of different scantlings contained in a St. Petersburg standard.

Sciography. By ROBERT PRATT. London: Chapman & Hall. 1891.

THE programme of the new system of examinations now being established by the Royal Institute of British Architects demands from the candidates a knowledge of sciography, a branch of draughtmanship which has hitherto received but little attention from English architectural students.

The work now before us, therefore, appears very opportunely, and will be found a useful help to the study of the subject, containing, as it does, a course of exercises in architectural and engineering drawing.

The student is assumed to have already gone through an elementary course of descriptive geometry and perspective so as to be familiar with the ordinary projection of figures. Starting with this knowledge, the examples given will be found of value in the study of the projection of shadows.

The exercises given are graduated in difficulty, the subject being treated first of all with reference to parallel rays of light casting shadows, then with the sources of light from one or two points, reflections, and the treatment of shadows in perspective.

The book will probably be found of most value to students who have the advantage of a teacher to explain difficulties, and particularly to show them the technique of the laying on of shadows, especially where gradated, which is not touched on in this work. Neither the Continental system of getting gradation by zones is alluded to any more than that of obtaining regular gradation by changing the depth of the tint either from light to dark or dark to light.

The Statutory Trust Investment Guide. With an Introduction by RICHARD MARRACK, Barrister-at-Law. London: F. C. Mathieson & Sons. 1891.

THIS little book will be of great service to trustees and to those prudent men of business who invest their savings in first-class securities. There are nearly one hundred pages of so-called introduction, which are really a clear explanation of the Trust Investment Act, 1889. The text of the Act is then given, and some of the Court Rules, and finally a classified list of the different stocks available under the Act in question. This description of the book will sufficiently explain its purport. The work is well done, is in a convenient form, and will be of general use.

Packing-case Tables: showing the number of superficial feet in boxes and packing-cases. Compiled by W. RICHARDSON, accountant. Third Edition. London: Crosby Lockwood & Co. 1891.

THIS is a set of tables giving at a glance the number of superficial feet in a packing case of which the three dimensions are known. They are very simple in application and apparently correct.

GLASGOW ARCHITECTURAL ASSOCIATION.—On the 22nd ult., the members of the Glasgow Architectural Association visited the house which is being erected in Great Western-road, Glasgow, for Mr. A. P. Anderson, and of which Mr. T. L. Watson, F.R.I.B.A., is architect. The style adopted, English Gothic of the sixteenth and seventeenth centuries, affords a marked though not inharmonious contrast with its Classic neighbours. Picturesque grouping and variety of form is obtained by tall chimneys, many gables, and timber-work; colour by the red stone of two shades, ornamental brick filling,—cement also,—of timber quarterings, green slates, and tile ridgings, and crests. Internally the chief features of interest are the hall and the staircase. The former is a large apartment rising the height of two stories, with an open timber roof, a gallery of woodwork at one end, space for a large organ, and a fireplace recess with hooded stone chimney-piece. The staircase has stone arcadings, both large and small, enriched with carving and diaper work. Mr. Wishart, clerk of works, conducted the party and gave all necessary explanations.

Correspondence.

To the Editor of THE BUILDER.

THE CONVENTUAL KITCHEN.

SIR,—I observe from your report (September 5, p. 183) of the visit of the British Archæological Association to Fountains Abbey, that my friend Mr. Loftus Brock, in giving evidence for and against the identification of the room on the east side of the refectory as the kitchen, inclined to the affirmative opinion. If he had spoken more decidedly, he would have been justified by very eminent authorities. Mr. Edmund Sharpe always called the rooms so placed kitchens, but I have long since urged that this view is erroneous, and that the true conventual kitchen is the room on the west side of the refectory, which, besides the fireplaces which can usually be traced, possesses also the hatch through which the rations were passed to the refectory. Mr. Sharpe called this room "offices;" others have called it the buttery; but its situation between the refectory and the quarter occupied by the lay brethren, the servants, and the stores should alone be sufficient to identify it as the kitchen.

The room on the eastern side of the refectory also has fireplaces, but before we can accept this as the kitchen we must believe that it was the universal practice in Cistercian monasteries to carry the food past the refectory to be cooked and to carry it back again past the refectory to the "offices" to be handed through the serving hatch. This would be like putting the kitchen of a house between the dining-room and the drawing-room, carrying the viands to and fro as above described, and serving them from the pantry or scullery.

There can, I think, be no reasonable doubt that the eastern room was the calefactory, or place specially contrived for the monks to warm themselves, though it may be that some of their occupations requiring a warm place might be carried on there. There was originally no other place where a monk could, in his ordinary routine, see a fire, though fireplaces were added at Furness and elsewhere to the place commonly called the fratry, or day-room, originally cold, or even open to the elements.

The fireplaces at Fountains were very well adapted for giving warmth to a row of persons extending along the eastern side of the room. At Tintern the hearth is in the centre of the room, four piers at its corners carrying the chimney, so that about ten persons could assemble round the fire. There the room is actually separated from the refectory by a narrow cell or store, while the western room is manifestly a kitchen with fireplaces and hatch. There may,—I suppose there must be,—some evidence to support the view which Sharpe and other authorities have held. The only evidence that I can call to mind is the existence of "a large and fine oven" in the eastern room at Croxden (see Mr. Gordon Hills' description in the "Journal of the British Archæological Association" for 1865), but this is only a slender support to so improbable a theory.

THOMAS BLASHILL.

Spring Gardens, S.W., Sept. 23, 1891.

FALKLAND PALACE.

SIR,—I read in your issue of Saturday last a letter signed "Robert Little, F.S.A.Scot.," in which the writer takes the Marquess of Bute most seriously to task for what he considers to be vandalism. This letter is almost identical with one which appeared in the *Glasgow Herald* of the 12th inst. So far as I know, it elicited no response, and till Saturday I fancied it had fallen lifeless.

I write this to ask archæologists and the profession to suspend their judgment on the matter for a short time. As soon as I get a little leisure I mean to finish a short paper on the Palace, which may place some things in a different light; and meanwhile I venture to think that if this critic's knowledge had equalled his zeal, he would not have written the letter he did.

CAMPBELL DOUGLAS, F.R.I.B.A.

266, *St. Vincent-street, Glasgow*,
September 29, 1891.

VARNISHED CARVING.

SIR,—Will you or some brother reader kindly help me out of a difficulty with a little advice?

We have been carving a large oak overmantel. It has been a very long time on hand. Some of the panels were put into the ammonia bath about five years ago, a portion of the overmantel roughly put together, and, with careful attention, the panels were in a very nice condition.

On completing the other parts, the whole was sent to be put together properly, with directions to carefully bath the new work. On receiving it back I find the whole thing,—new and old,—covered over with a thick coat of a nasty, treacly-coloured, shiny varnish, and it is not, even with this stuff on, one colour, so that there could not have been this excuse, and yet the whole thing is very dark, and every bit of nice feeling completely taken out of it. The varnish looks like naphtha and shellac.

Can anything be done to satisfactorily remove this without injuring the carving or wood, and to leave it like it ought to be if rubbed in the first instance with beeswax and turpentine?

Would it be possible to satisfactorily ammonia bath the new work now, if I find it has not been treated that way when the varnish is removed?

J. T. C.

Sheffield, September 26, 1891.

AN OLD CARVED STONE IN CLARE MARKET.

SIR,—Adverting to your "Note" of 29th ult., I think the carved stone on the house in Gilbert-street is the coat-arms of John Holles, second Earl of Clare, who died in 1665, for I can decipher a date "[16?]59"; the broken coronet is an Earl's (two of the points, with pearls, remain); and the charge of the shield corresponds with that of the Earls of Clare given in Sir Bernard Burke's "Dormant . . . . and Extinct Peerages," 1883, namely, "*Erm.* 2 piles in point, *sa.*" The dexter supporter is a lion rampant. The sinister resembles a unicorn. The two mottoes I can't read clearly. There was no Earl of Clare, of the Holles house, in 1559 or in 1759. John Holles, first Earl of Clare, is said to have owed his creations as (1) Baron Houghton in 1616, and (2) Earl of Clare in 1624, to the Duke of Buckingham, and two douceurs amounting to 15,000*l.* At his advancement to the earldom objection was raised that that title was peculiar to the Crown.

D. M.

ARCHITECTURAL ASSOCIATION EDUCATION PROGRAMME.

SIR,—I have before me the notice sent out by the "Architectural Association" for the coming sessional lectures to students, but it strikes me that the fees of 10*l.* 10s. for the course will operate against its success, which all should desire, as I take it to be the intention of the Committee to enlist as great a number as possible, and for this purpose I think a payment of 5*l.* 5s. would have been crowned with better results.

ANXIOUS FOR SUCCESS OF THE A.A.

RUSHES AS A KEY FOR PLASTERING.

SIR,—Mr. Lovegrove's letter on this subject, in your issue of September 5, has recalled to my memory that many years ago, when I was making a walking tour through Scotland, I halted for a day or two at Oban, and went at once to examine the ruins of Dunolly Castle, standing close by. When within the stone walls of the keep, I remarked that those walls must originally have been plastered, for some of the old plaster, in patches, was still adhering loosely to them. On inspecting this plaster more closely, I observed that the mortar had been spread or laid upon a a flat net-work or basket-work of withies, and where the sticks or twigs had decayed and rotted out, the empty hollows remained visible in the mortar. I looked upon it as a primitive mode of battening.

P. O. HUTCHINSON.

"————ON SEA."

SIR,—I observe by an advertisement in your issue of to-day that the picturesque and hitherto almost unaltered fishing village of Leigh is in future to be dignified with the needless and ridiculous suffix "On Sea." This generally marks the beginning of the end, where any place of interest is concerned, so that it is only natural to assume that Leigh will soon put on all the airs and graces of a fourth-rate watering-place. What has the place done that it should be dubbed "on Sea"? and why on *Sea*, when the nearest open sea is six miles to the eastward? I observe, too, that the village is described as "overlooking the Channel." What "Channel"? None is discoverable on the map, save and except the muddy creek separating Canvey Island from the mainland; but perhaps the term is only an instance of auctioneering licence. Why *West* Cliff Estate, too, when the only "cliffs" in the vicinity,—*i.e.* (I suppose) the broken, hilly ground north of the railway,—are east of the village? As there are several shop plots and a "grand" hotel site to be included in the sale, it is evident that extensive building operations are contemplated, with the view (or at least the result) of depriving Leigh of all its old rurality and quiet. Let those who wish to see it before this fate overtakes it make haste; next summer may be too late. Possibly by that time it will be a duly legitimised "on Sea," monotonous and uninteresting, to be carefully avoided by all lovers of the picturesque.

R. M. B.

London, September 25, 1891.

*** Our correspondent is probably right in his conclusions as to the intention with which the affix

"on Sea" has been added. It is generally affixed to a place which is not actually on the sea, in order to give a kind of fictitious attraction. We mentioned an absurd instance of this some time since in the case of Southend, where the old place, which actually stands on the shore, is called simply "Southend," and a new place which has been formed a mile up the country is called "Southend-on-Sea." In fact, "on Sea" in these cases is like the advertisement "Wines" in a pastrycook's window, which only tells us that there is no wine to be had there.

The Student's Column.

MARBLES.—XIV.

WEATHERING (*continued*).

FROM what has been said in preceding articles the student will be prepared to learn that the rate and methods of weathering of different kinds of marble must, to a great extent, depend upon the individual peculiarities of each. At the same time, whilst we must not lose sight of that fact, it is perfectly possible to arrive at a few generalities which are useful in enabling us to determine the durability of a marble in a ready manner in a greater or lesser degree. Leaving out of the question the properties relating to stability of colour, which we have already discussed, we may now proceed to consider the weathering of the main body of the stone, with special reference to those marbles used exteriorly.

First, let us examine an ordinary veined shell marble, mainly made of carbonate of lime. We know from the origin of this class that it has resulted from many operations carried out at different times, and under divers circumstances. At the commencement, we have the shells themselves, which originally accumulated on the floor of the sea, river, or lake, as loose *débris*—these are composed of lime. The next process was the cementing together of these shells and the filling up of interstices; the cementing and filling-up material is also of lime. Subsequently the solid rock thus formed was cracked across in various directions, the cracks being at varying distances from each other; these cracks are filled with lime, and veins result. The cracks were not all formed or filled up at one time, or even during the same epoch, whilst the whole stone may have undergone partial metamorphism in the true sense, or its structure may be somewhat modified by the solvent action of carbonated waters, both during the earlier and later stages of its formation. The effect of these phenomena can all be traced in the marble, which is thus seen to be of an exceedingly complex nature. Again and again we have endeavoured to demonstrate, in these columns, in some detail, that the action of the weather on stones composed of carbonate of lime is largely dependent on the form which that carbonate assumes in each particular kind of stone. We have seen that, apart from the different minerals formed (such as calcite and aragonite), the carbonate referred to exists in various stages of crystallisation and decomposition; it may even be to a certain extent earthy,—and all this in one marble. How, then, can we expect the stone to weather uniformly? Where the veins are made of more durable calcite than the remainder of the stone, they will stand up prominently from its surface when weathered; or, conversely, where they are not so lasting as the body of the stone, they are liable to be picked out, thus forming deep, unsightly, and dangerous cracks on its surface. The same remarks apply to the shells or corals in the marble, which may either be made to stand out in relief, or to produce holes and cavities under the influence of the weather.

The following hints may be observed in estimating the durability of such marbles as we have just described. Examine a well-polished surface of the stone carefully, and note those portions of it which have not taken a good polish or superior finish, and classify these dull portions accordingly. It will then frequently be observed that the dulness arises from the incapability of a certain mineral, or minerals, to take a polish, in which event the species of mineral so detected should be determined, and our remarks as to its nature applied in order to ascertain whether the delinquents are durable or not. If the dulness does not arise from the behaviour of any particular mineral, but is regional in its occurrence in certain definite and regular parts of the stone, it will generally be found that it is due to partial decomposition of the parts so affected, or from the circumstance that they are earthy in character. Thus, supposing a veined, coral, or shell marble exhibits a surface on which the veins and the corals or shells take a good polish, whilst various other portions of the stone do not, we should naturally expect to find that the veins, corals, &c., were more durable than the ordinary matrix, or cementing material associated with them. It need hardly be observed that where the stone, as a whole, does not take a good polish, it should be laid under suspicion. The foregoing are, of course, only rough-and-ready methods of estimating durability; under certain circumstances they would be liable to modification when the stone is examined in a more scientific manner. For instance, occasionally we find that the carbonate of lime in parts of certain marbles has not crystallised as calcite, but as aragonite. The latter mineral takes quite as good a polish as many of the better kinds of the former, but, as we remarked on a previous occasion, it is not so durable as calcite.

The student will be enabled to apply the foregoing principles to the selection of many other classes of marble in a greater or less degree; but it is a *sine quâ non* that he must be able to readily determine the species of minerals of which the commoner marbles are composed,—this is not a difficult matter. In certain stones the veins are made of quartz, which mineral has much superficial resemblance to calcite, but they can readily be distinguished from each other, amongst other things, in that calcite may be scratched by the point of a pocket-knife, whilst quartz is too hard to be capable of such treatment. Pure quartz is practically unaffected by the acids of the atmosphere, it being one of the most durable minerals known; moreover, it takes a beautiful polish, so that on first reflection it might be thought to constitute a desirable constituent of vein marbles; but this is not so on account of its refractory nature, which exerts great wear and tear on the ordinary marble-polishing machines. Of course, it is recognised as a valuable constituent in many of the igneous and metamorphic rocks which we have included under the general term "marbles"; in those cases it is associated with other minerals, which are also more or less refractory, but it is not advisable to work a marble the body of which is carbonate of lime and only occasional veins of quartz running through it.

Turning now to the consideration of those marbles and porphyries which contain felspar, we observe that the forms of that mineral are found to be disposed in many different ways. Felspar may be present in moderately-sized crystals, homogeneously distributed throughout the rock, not being more conspicuous than the remaining constituents; it may be in microscopic crystals, forming a kind of base in which other minerals are embedded; or it may occur as large crystals prominently displayed amongst the other components of the stone—the last-mentioned structure is known as "porphyritic." The durability of the felspars of either class is largely dependent upon their physical condition, which is best studied under the microscope. Mr. Merrill, in dealing with this subject, remarks* that in those stones which withstand the effect of the weather through long periods of years, without change or disintegration, the felspars, if examined with a microscope, will be found hard, compact, and fresh, containing but few cavities or impurities. On the other hand, the felspars of many rocks, if thus examined, will be found filled with minute cavities and flaws, which are often so filled with impurities and products of decomposition as to be quite opaque. Such rocks will not for any length of time withstand the weather, since infiltrating waters containing minute quantities of carbonic and other acids, aided by heat and frost, cannot fail to produce the result of disintegration.

In certain rocks where the felspars are partially surrounded and protected from atmospheric influences by other more durable minerals, special reservations have to be made, but in porphyry,—the class of ornamental stone now under review,—the felspars have very little of this protection afforded them, and the durability of the porphyry is, therefore, essentially governed by the physical condition of its contained felspars.

Serpentine, as a rule, weathers very badly in the smoky atmosphere of large towns, though from its beauty it has frequently been employed in exterior decoration. The full description already given of the marble will enable the student to comprehend the chief causes of this, so that further explanation is unnecessary.

In regard to the weathering of ordinary white statuary marble, we may merely remark that when its calcite is well crystallised,—as it almost always is,—and has not undergone much decomposition, it is as durable as any of the other classes of marble which consist of carbonate of lime. It is not so enduring as some of the ordinary freestones, granites, and porphyries, and no one, from that circumstance alone, could recommend it or any similar kind of marble for outdoor work. At the same time, high-toned sculptured work must of necessity, from an artistic point of view, be chiselled out of those marbles which are mainly composed of calcite, whether such be placed indoors or out, so, in the latter event, it is inevitable that in our climate they cannot last very long. Would that this were not the case.

There is one more point affecting the disintegration of marbles in general,—we allude to variations in temperature. In Great Britain this element is not of much importance, but in the United States and in tropical countries it plays a conspicuous part as an agent of waste. Rocks expand on being heated, and contract on cooling; and, as a rule, they possess but a low conducting power and slight elasticity. In parts of the United States the variation in temperature in twenty-four hours amounts to as much as 40 deg. Fahr.; and we are informed that in Western America, where the climate is remarkably dry and clear, the thermometer often gives a range of more than 80 deg. per day. The rapid contraction the stones experience during sudden falls of temperature eventually leads to their disintegration by exfoliation and otherwise. Experiments carried out by Colonel Totten* with a view to ascertain the actual expansion and contraction of various building stones showed that the rate for crystalline marble was ·000005668 in. per foot each degree Fahrenheit, when subjected to ordinary temperatures.

* Merrill, "Smithsonian Report," 1886, pt. ii., p. 295.

* Totten, "American Journal of Science," XXII., p. 136.

GENERAL BUILDING NEWS.

ST. BARNABAS CHURCH, MIDDLESBROUGH.—On the 22nd ult. the foundation-stone of the new Church of St. Barnabas, Linthorpe, Middlesbrough, was laid by Sir Raylton Dixon. The new structure, which is intended to accommodate 753 persons, is estimated to cost with the site a little over 6,000*l*. It will occupy a position at the corner of the Linthorpe and Cemetery-roads, and will be of a plain Gothic style of architecture of pressed bricks with stone facings, stone arcades, and chancel arch, and will consist of a nave with two side aisles opening into it by arcades of five spans, with a chancel, two vestries, organ-chamber, &c. Mr. C. Hodgson Fowler, of Durham, is the architect.

NEW SHELTER, MIDDLETON CEMETERY, NEAR MANCHESTER.—On Saturday, the 19th ult., a new shelter was opened in the cemetery at Middleton, near Manchester. It is built in the Gothic style, and occupies a commanding position in the town. The bricks used are local, relieved by terra-cotta dressings, made by Messrs. Edwards, of Ruabon. The contractor was Mr. F. Jackson, and the architect Mr. J. A. Fitton, both of Middleton.

PUBLIC BATHS, ASTON.—On the 23rd ult. foundation-stones were laid, by Messrs. L. S. Richards and William and Edward Ansell, of the Public Baths for Aston Manor. The buildings are described as Classical Renaissance in style, and the material to be used for the front elevation is bright red terra-cotta. The baths will have a frontage of 80 ft. to Victoria-road, and the height of the façade from ground to cornice will be 18 ft., and to the ridge of the centre pediment 40 ft. Under this centre pediment will be an arched doorway, which will be used as the ladies' entrance to the baths, and at either end of the frontage will be the entrances to the first and second class baths for gentlemen. The ticket office will be in the centre of the front block, and so arranged that a single official can command the three entrances. Just inside the central porch there will be eight private baths for ladies on either side of the centre entrance. Inside the first-class entrance will be five private baths, and a staircase at one side will lead to the committee room, situate in the main frontage. From the other side of the entrance the first-class swimming-bath will be approached. This will be 78 ft. long by 39 ft. wide, and the depth will vary from 3 ft. 6 in. to 6 ft. 6 in. The superficial water area of the bath, which will be lined with white glazed brick, will be 3,042 ft. Forty-three dressing-rooms, divided by brick partitions, will be provided, together with a hot-room; and a promenade gallery, capable of holding 500 persons, will run round three sides of the bath. The building materials are pressed red brick relieved by bands of buff brick and a dado of glazed white brick

finished with coloured string-courses. Light will be admitted from a skylight and circular windows at either end of the baths. At the other end of the building will be the second-class swimming-bath, similar in design to the first-class bath, measuring 60 ft. by 33 ft., and having a superficial water area of 1,980 ft. There will be fifty-nine dressing-boxes here, separated by wooden partitions, and a soap plunge bath will be provided. The engine-house will be at the rear of the second-class baths, and the caretakers' residence will front on Albert-road. The water supply will be obtained from an artesian well, situated under the engine-house, and a storage tank is provided immediately over the engine-house, with a capacity of 24,000 gallons. The water will be pumped directly into this tank. The engine and pumps are being supplied by Messrs. Piercy & Son, of Birmingham. Adjoining the engine-house, and underneath this and extending towards Albert-road, is a boiler-house. Two Lancashire boilers, 26 ft. by 7 ft. diameter, will be required, and these are being constructed by Mr. Edwin Danks, of Oldbury. The contract for the hot and cold water supply-pipes, steam-pipes, and general heating work has been given to the Griffin Foundry Co., Birmingham. A subway runs from the boiler-house underneath the corridors, and between the private baths. It is estimated that the whole of the work will be executed at a cost of about 12,000*l*. The architect is Mr. W. Augustus Davies, Assoc.M.Inst.C.E., Engineer and Surveyor to the Aston Manor Local Board. Mr. J. H. Smith is clerk of the works, and the contractor is Mr. F. N. Stephens, of Aston. The terra-cotta is being supplied by Mr. Edwards, of Ruabon. The well has been sunk and the boring is being done by Mr. F. North, of Aston.

Bank Premises, Newcastle.—Some new banking premises have just been erected in Collingwood-street, Newcastle-on-Tyne, for Messrs. Hodgkin, Barnett, Pease, Spence, & Co. The new bank is in the Italian style, and has a frontage of about 100 ft., with a height of 53 ft. or 54 ft. The principal entrance is in the centre, through a door-case of dark red granite. All the rest of the front, except the plinth, which is also of granite, is of Gunnerton freestone. There are square windows on the ground floor with rusticated quoins, and above a string-course of nine windows on the first floor with architraves and pedimented heads. The windows of the second floor are plain rectangular openings with architraves. Above, there is a cornice with swags of flowers in the frieze. A parapet with vases at the angles finishes the front. Internally the basement is chiefly occupied by the safes and strong-rooms. Lavatories for clerks, chambers for heating, and so forth, are also arranged on this floor. The banking-room and partners'-room, with two waiting-rooms, occupy all the ground floor except the space required for staircases. The banking-room is panelled round with oak for about 6 ft. in height. There is an hydraulic lift for raising and lowering the books to the basement. The upper floors of the building contain rooms for the partners, and a residence for clerk and caretaker. The architect is Mr. R. J. Johnson, of Newcastle, and the contract has been carried out by Mr. Walter Scott; and the clerk of the works is Mr. W. R. Bennett.

The Extension of Aberdeen Medical College.—As the outcome of negotiations between the authorities of Aberdeen University and representatives of the Town Council, the Improvements Committee of the latter body resolved, on the 25th ult., to recommend the Council to approve of a scheme for the extension of Marischal College, at a probable cost of 60,000*l*. It is proposed that the Council should make a contribution of 10,000*l*. towards the cost of the undertaking, and provide a further sum of 5,000*l*. for the erection of a new church to replace, on a different site, the present Greyfriars' Church in the college quadrangle.

Church Schools, Wilmslow, Cheshire.—On the 26th ult. Mr. R. B. M. Lingard-Monk, of Falshaw Hall, Wilmslow, laid the corner-stone of the new church schools in Water-lane, Wilmslow, which are to cost about 1,700*l*. The new building will embrace a main schoolroom 55 ft. by 22 ft., with vestibules and the usual offices. Mr. Lord, of Manchester, is the architect, and the contract is in the hands of Mr. J. K. Coates, Wilmslow.

Re-opening of Bow Church.—Bow Church, which is situated in Bow-road, was re-opened on the 23rd ult. by the Bishop of Bedford. For six weeks this building has been undergoing repairs. The ancient box pews have been replaced by open seats. A bed of concrete, overlaid with blocks of wood and tiles, has been substituted for the flags and tombstones that served for a floor. The side aisles remain, but a nave has been added. The altar has been raised, and the floor covered with encaustic tiles. Sir A. Blomfield has carried out the alterations at a cost of about 350*l*.

Banking Premises, Bradford.—Contracts have been entered into for banking premises in North-parade and Manor-road, Bradford, for the Yorkshire Penny Bank. Mr. Jas. Ledingham, of Bradford, is the architect.

New Mission Hall near Harlow, Essex.—This Saturday, October 3, the Bishop of Colchester opens a recently completed Mission Hall, at Burnt Mill, near Harlow, Essex, for the Rev. W. Carlile, the founder and hon. sec. of the organization known as the Church Army. The foundation-stone was laid in May last by Sir Henry Selwyn-Ibbetson, Bart., M.P., and the building will be used as a Parochial Mission Hall and Mission Church. It is built of red bricks, with Broseley tile roof and half timber, brick-nogged, to gables and porch, the windows being filled with rough green cathedral glass. The building has been carried out from the design and under the superintendence of Mr. Leonard Martin, now of the firm of Messrs. Treadwell & Martin, of Waterloo-place. The building has cost about 500*l*., the contractors being Messrs. French & Ellwood, of Westminster.

FOREIGN AND COLONIAL.

France.—An expedition of French engineers and savants is to leave shortly for Asia Minor to visit the excavations at Sardis.——The authorities of Jura-Simplon have just published the technical report of M. Dumur, engineer, on the studies made in 1890-91 in regard to the tunnelling of the Simplon. The tunnel would be 19,731 mètres in length, and the cost is estimated at 71,600,000 francs. The report gives eight and a half years as the probable time necessary for the completion of the work.——The new Hôtel des Postes at Saïgon (China) is to be opened shortly. The building, very rich in its ornamentation, does great credit to M. Foulhoux, the architect-in-chief of the colony, who was the designer of the Pavillon des Colonies, on the Esplanade des Invalides, in the 1889 Exhibition. —— An important archæological discovery has been made in the course of recent excavations at the priory of Grainville-Ste. Honorine, near Havre. Two staircases have been found on the south-east side of the abbey, abutting on a cloister, which had been walled up. Further on was found another staircase, vaulted, the outlet of which had also been walled up, and which was in perfect preservation. A covered passage, parallel with the cloister, leads to a subterranean apartment under the terrace of the church. M. Naef, the architect who superintended these excavations, hopes to find some graves of the priors of this ancient monastery.——The inauguration of the monument raised at Thiais (Seine) to the memory of the soldiers killed in the contests of September 30, 1870, is to take place to-morrow. The monument designed by M. Blondeau (architect), is composed of a hexagonal pedestal supporting figures of two wounded soldiers, executed by M. Raoul Dufresne, sculptor. —— The Republican committee of the territory of Belfort has decided to raise a monument to the memory of Dr. Louis Frèry, senator, recently deceased. The execution of the monument is confided to M. Falguière.——M. E. Guillaume, the new director of the French Academy at Rome, has suffered in his health by the Roman climate, and has returned to Paris for the present. He will not return to his post until his health is entirely re-established.——The Municipal Council of Fontainebleau has addressed to the Goverment an energetic protest in regard to the removal of furniture of great value from the palace at Fontainebleau at the time of the Universal Exhibition, which has never been restored. Among the objects of this kind, the absence of which is much remarked by visitors, may be named especially the furniture of the Marie Antoinette drawing-room and that of the former apartments of the Queen-Mothers. The protest has remained so far without reply.——The inauguration of the monument to Garibaldi at Nice has been definitely fixed for Sunday, October 4.

Extension of the Simla Waterworks.—It is extremely satisfactory to know that the Punjab Government are disposed to act in a liberal spirit towards the Simla Municipality in the matter of the water-works extension and the much-needed completion of the sewage scheme. The cost of these projects has now been fixed at Rs.7,10,000. Towards this sum the Government of India has been asked to make a grant of Rs.3,00,000, the Local Government offering to bear the full charge of establishment, supervision, and other incidental charges (Rs.80,000), and to lend the balance at 4 per cent., without insisting upon a sinking fund being provided. The conditions which it insists upon are that the details of the water-works scheme shall be settled in the local Public Works Department, and the work of construction be carried out by that agency. The Municipal Committee on their part are perfectly willing to leave all details to the P. W. D. officers; though they urge, and with justice, that it is essential to secure the filtration of all water supplied to the station, together with increased facilities for storage. After the experience of the last few months, in which a season of drought was followed by an exceptionally heavy downpour, resulting in serious damage to the works on the catchment area, there can be no doubt that more reservoirs are required. It is a little too ridiculous for a large station like Simla to be put on short allowances of filtered water in the middle of the rains.—*Indian Engineer.*

MISCELLANEOUS.

Ecclesiastical Art Exhibition at Rhyl.—The Ecclesiastical Art Exhibition to be opened on Monday next in connexion with the Church Congress at Rhyl will, we are informed, include an interesting loan collection of specimens of every branch of ecclesiastical art, both ancient and modern, including silversmiths' work, medals, enamels, embroidery, tapestry, bronzes, books, manuscripts, paintings, engravings, and rubbings of monumental brasses. The Duke of Westminster sends an old embroidered cope set as a screen. The Rev. Chancellor Espin has sent an interesting set of water-colour drawings of Chester Cathedral, taken in June, 1814, by Thomas Espin, F.S.A., of Louth, one of the first members of the Society of Antiquaries. The drawings exhibit the cathedral from various points of view. When the cathedral was being restored about twenty years ago, these views were placed at the disposal of Sir Gilbert Scott, and are stated to have been of much service to him, as exhibiting many details which had since perished. There appear to be many other interesting exhibits in this loan collection.

Electric Lighting in Liverpool.—An installation on Andrews's system has just been completed at the Waterloo Grain warehouses, belonging to the Mersey Docks and Harbour Board. The chief feature of this system is that the outer or return conductor is of iron uninsulated, forming a substantial protection to the insulation of the inner (copper) conductor, and making with the solid brass cases of the cut-outs, switches, &c., an unbroken conductor throughout. Switches and cut-outs act only on the centre wire. No wood casing whatever is required. The Waterloo warehouses consist of three six-story blocks, 80 ft. wide, built along three sides of the Waterloo Corn Dock. The middle block is 180 ft. long, and the side blocks are each 650 ft. At intervals along the centre of each block, hatchways for hoisting purposes reach from the quay level to the top of the building, and up each of these a branch wire securely fixed in an angle iron is carried, and conveys currrent to two sockets at each floor. Long lengths of steel-armoured flexible wire, provided with couplings to fit these sockets, are used for attaching the lamps. Each flexible wire supplies one 50 c.p. lamp, which can thus be moved about the room, and placed in the most convenient position for working by, and a number of lamps can be grouped wherever a bright light is required. Similar sockets and flexible leads are arranged for carrying lights right down into the holds of vessels lying in the dock, so that the trimmers on board may also have plenty of light for their work. The dynamo in connexion with this installation is of Messrs. W. T. Goolden & Co.'s make; it is driven by a belt from an engine of the inverted vertical marine type, steam being supplied by the main boilers used for the hydraulic system on the Dock estate. The installation has been carried out to the specification of Mr. G. F. Lyster, the Dock Engineer, by Messrs. J. D. F. Andrews & Co., of London, S.W., with the assistance of Mr. W. S. Boult, Assoc.M.-Inst. C.E., Liverpool.

Liverpool Corporation Churches.—At the weekly meeting of the Finance Committee of the Liverpool Corporation on the 25th ult., the Town-clerk presented his report upon the position of the City Council in respect to the Corporation churches. On the motion of Mr. J. B. Smith, seconded by Mr. Rathbone, it was resolved:—"that, in the opinion of the committee, it is desirable that Parliamentary powers be obtained for making provision for the extinction of the present liabilities of the Corporation in connexion with the Corporation churches, and for the pulling down, removing, or otherwise dealing with some of the churches, subject to such terms and conditions as may be imposed by Parliament, and with this object the Council be recommended to refer the consideration of the matter to the Parliamentary Committee, with instructions to prepare a scheme for submission to the Council."

The English Iron Trade.—The English iron market generally maintains its improved condition. The Glasgow warrant market is, however, again quieter. Middlesbrough pig is very firm at last week's quotations. An unfavourable feature is the inactivity in the hematite iron trade of the north-west; but prices, in spite of the lack of orders, remain steady. Manufactured iron shows a further advance this week, and there is more activity noticeable in the steel trade; but in the north-west all descriptions of steel are very dull. Tinplates continue quiet; but more encouraging reports are to hand with regard to Amerioan requirements. Shipbuilding exhibits fair activity; but engineers are slacker. Coals are in moderate demand.—*Iron.*

Surrey Archæological Society.—The members of the Surrey Archæological Society will, this Saturday, October 3, by permission of Lord Dysart, visit Ham House, Petersham. This house, built early in the seventeenth century, practically remains unchanged, and is filled with art treasures. Mr. S. W. Kershaw, F.S.A., has prepared a paper on the history of the house. This paper will be read at 3 p.m. punctually, after which the party will walk through the principal rooms and inspect the pictures, &c.

COMPETITION, CONTRACTS, AND PUBLIC APPOINTMENTS.

COMPETITION.

Nature of Work.	By whom Advertised	Premium.	Designs to be delivered.
*Truants' School at Lichfield	Burton-on-Trent, Walsall, and West Bromwich School Boards	.....	Nov. 21

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
*Kerbing, Tar Paving, &c. Works	Hendon Local Board	S. S. Grimley	Oct. 5
Dispensary Building	Belfast Union	Young & Mackenzie	Oct. 6
*Kerbing and Forming Footpaths	Tottenham L. B.	J. E. Worth	do.
Penmaenmawr Road Stone	Middlewich Loc. Bd.	*Official*	Oct. 7
Warehouse Shed, St. John's-road, Huddersfield	.....	C. S. Nelson	do.
Covering Service Reservoir	St. German's R.S.A.	J. C. Inglis	do.
Cast-iron Water Pipes	Northallerton Loc. Bd.	A. M. Fowler	do.
*Granite Sett Paving	Hammersmith Vestry	H. Mair	do.
Road Metal	Sevenoaks Local Bd.	J. Mann	Oct. 8
Alterations to Workhouse Hospital	Cardiff Union	*Official*	Oct. 9
*Iron Girder Bridge	Margam Local Board	W. Thomas	Oct. 10
*Erection of Public Hall	Lewes Town Council	S. Denman	do.
Levelling, Paving, &c.	Batley Town Council	J. H. Horsfield	do.
*Precipitating Tanks, &c.	Rye Union	*Official*	do.
*Road Works	Lewisham Bd. of Wks.	do.	do.
Three Tenements	Glasgow Impt. Trus.	do.	Oct. 12
*Repairs to Pitching, City-road	St. Mary's (Islington) Vestry	do.	do.
*Making-up Road	do.	do.	do.
Road Metal (1,500 tons)	Ryton (Parish) Loc. B	T. P. Salter	do.
*Loose Boxes, Alterations, &c., Liverpool road Depôt	Islington Vestry	J. Patten Barber	do.
Seven Houses, Hermon-grove, Parkinson-lane, Halifax	.....	Lloyd & Son	do.

CONTRACTS.—*Continued.*

Nature of Work or Materials.	By whom Required.	Architect, Surveyor or Engineer.	Tenders to be delivered.
*Municipal Lodging House, Drury-lane	London County Council	Gibson & Russell	Oct. 13
*Roadmaking and Paving Works	Willesden Local Board	C. Claude Robson	do.
*Drainage Works, Paddington Cemetery	do.	do.	do.
*Broken Guernsey Granite	do.	do	do.
*Construction of Branch Railway and Footbridge	L. & N. W. R. Co.	*Official*	do.
Sanatorium, near Workhouse, Westwell	West Ashford Union	do.	Oct. 14
*Water Supply Works, Melton	Suffolk County Asylum Committee	G. Hodson	Oct. 16
Alterations and Additions to Laundry Buildings, Asylum, Upton	Chester C. C.	Stanhope Bull	Oct. 17
New Road and 30 Cottages, Dinas Powis, near Cardiff	Building Club	W. H. D. Capel	do.
*Surface Water Sewers	Eastbourne Twn Coun.	*Official*	Oct. 19
*Drain Pipes, Coals and Stores	Croydon Council	do.	Oct. 20
*Front Improvement Works	Borough of Ramsgate	W. A. Valon, C.E.	Oct. 21
*School of Medicine, Leeds	Council, Yorks College	W. H. Thorp	Oct. 22
Granary and Corn Stores, Ludlow	Marston Bros.	.....	No date
*Rewharfing Premises	S. Cutler & Son	.....	do.
*New Hall, Yorkshire College, Leeds	.....	A. Waterhouse & Son	do.
New Premises, Flimby	Maryport Co-op. Indus. Soc. Lim.	*Official*	do.
Farm House, Moss Farm, Plumbley, near Northwich	.....	F. W. Stocks	do
Alterations and Additions to Oddfellows' Hall, Plymouth	District Trustees	F. A. Wiblin	do.
Mechanics' Shops, Armley-road, Leeds	.....	J. Charles & Sons	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.
Surveyor	Winsford Loc. Bd.	130*l.*	Oct. 7
Clerk of Works	Bristol U.S.A.	3*l.* 3*s.* per week	do.

Those marked with an Asterisk (*) are advertised in this Number. *Competition p.* iv. *Contracts, pp.* iv., vi., *and* viii. *Public Appointments, p.* xxi.

NEW REREDOS AT ST. THOMAS'S CHURCH, RHYL.—In anticipation of the meeting of the Church Congress, the chancel of St. Thomas's Church, Rhyl, has received an addition in the shape of a new reredos, the gift of Mr. R. Bamford Hesketh, of Gwrych Castle, Abergele. The architectural framework and surroundings are of polished veined alabaster, and all the sculpture is of white alabaster, the super-altar being of solid Devonshire marble. The central feature is a group of the Crucifixion, and in the panelling on each side, divided by pinnacled buttresses, are angels kneeling in attitudes of devotion. A carved and battlemented cornice of unequal elevation surmounts the whole. Extending from the reredos on each side, filling up the space on the east wall, and continuing along the north and south walls 18 ft., is an arcading of Caen stone supported by marble columns, the divisions being filled with a design of embossed terra-cotta tiles. The whole has been executed by Messrs. Earp & Hobbs, of London.

BUILDING IN GLASGOW.—Lord Dean of Guild Ure, Glasgow, in making his annual statement on the 24th ult., mentioned that during the two years of his Deanship buildings had been authorised the computed cost of which was over one million pounds sterling. During last year the plans of several public halls, churches, and schools were passed, the value of which was about 50,000*l.* House and shop property to the value of 293,500*l.* was also authorised, and warehouses, stores, and workshops to the value of 179,000*l.*; while plans for alterations and additions to the amount of 68,000*l.* were passed. The dwelling-house property authorised was 1561 as against 1253 the previous year.

NEW ORGAN AT ADDISCOMBE, NEAR CROYDON.—The three manual organ built by Messrs. W. Beales & Co., of Limes-road, Croydon, and just erected in the Church of St. Mary Magdalene, Addiscombe, will be opened on Friday next, the 9th inst., by Dr. E. J. Hopkins, of the Temple Church. The instrument, a divided one, is erected on either side of the chancel, the centre pipes being arranged on coved brackets; an additional front is also shown towards the north aisle. The organ is enclosed in an oak case, designed, together with the decoration of the front pipes, by Mr. E. Stanley Walters, architect, of Park-hill, Croydon. A special feature has been made of the front facing the north aisle, which is designed in three open-moulded arches, with cusped heads springing from the caps of slender circular shafts, behind which is hung a crimson velvet curtain, the whole surmounted by a richly-moulded cornice supporting the decorated pipes. Four new brass gas-standards, manufactured by Messrs. Hart, Son, Peard, & Co., have also been fixed in the choir stalls.

REMOVALS.—We are asked to mention that Mr. Thos. W. Aldwinckle has removed from 2, East India-avenue, E.C., to 1, Victoria-street, Westminster.——The Wood Block Flooring Company have removed from 22, Charing-cross, S.W., to 11, Queen Victoria-street (Mansion House-chambers), E.C.

LECTURES AT THE BIRKBECK INSTITUTION.—We are asked to state that the lectures in land surveying to be given by Mr. H. Bushell at the Birkbeck Institution will commence on Tuesday evening next at 6.30, the first lecture in quantity surveying commencing at 7.33 the same evening, instead of as printed in our last issue.

LONDON SOCIETY FOR THE EXTENSION OF UNIVERSITY TEACHING.—A course of ten lectures on "Electricity and its Modern Applications," by Mr. A. H. Fison, D.Sc., F.R.A.S., will be given at Chelsea Town-hall, on Wednesdays, at 8.15 p.m., beginning October 7. Artisans and members of men's or women's friendly societies will be admitted to the course at a small fee. The course will be devoted to the study of the elementary principles of electricity, having special reference to the more important of its modern applications. The first lecture of the course will be free.

MEETINGS.

SATURDAY, OCTOBER 3.

Surrey Archæological Society.—Visit to Ham House, Petersham. Paper by Mr. S. W. Kershaw, F.S.A., on the history of the house.

MONDAY, OCTOBER 5.

University College.—Professor T. Roger Smith's Opening Lecture on Architecture. Subject: "New Departures in Architecture." 7.30 p.m. (Admission free and without ticket).

Society of Engineers.—Mr. Henry O'Connor on "Retort Charging and Discharging Machinery for Gas Works." 7.30 p.m.

Clerks of Works' Association (Carpenters' Hall).—Monthly meeting. 8 p.m.

Liverpool Architectural Society.—Opening address by the President, Mr. T. Harnett Harrison. 7 p.m.

TUESDAY, OCTOBER 6.

Sanitary Institute (Lectures for Sanitary Officers).—Sir Douglas Galton on "Ventilation, Warming, and Lighting." 8 p.m.

Glasgow Architectural Association.—Mr. Andrew Robertson on "Structural Ironwork." 8 p.m.

WEDNESDAY, OCTOBER 7.

Auctioneers' Benevolent Fund.—Annual General Meeting. Auction Mart, 4 p.m.

London Society for the Extension of University Teaching (Chelsea Centre).—Mr. A. H Fison, D.Sc., on "Electricity and its Modern Applications." I. 8.15 p.m.

THURSDAY, OCTOBER 8.

British Museum.—Miss Millington-Lathbury on "Greek Dress." 3 p.m.

FRIDAY, OCTOBER 9.

Sanitary Institute (Lectures for Sanitary Officers).—Mr. H. Law on "Principles of Calculating Areas, Cubic Space, &c.; Interpretation of Plans and Sections to Scale." 8 p.m.

RECENT PATENTS:

ABSTRACTS OF SPECIFICATIONS.

13,141.—WATER-CLOSETS: *W. H. Drayson.*—The main points of this specification are: (1) In a valve closet placing the fulcrum of the valve actuating lever between the actuating-rod and the tumbler; (2) the combination of the overflow passage from the basin with a receiver having a waste-pipe conducting the water away, independently of the closet-box or trap; (3) the combination of an apron-basin with an ordinary valve-closet; and (4) in the arrangement of the aforesaid parts as a whole.

13,342.—SCREWS, &c.: *J. Andrews.*—The screw which is the subject of this patent has on the shank one complete thread and a groove and portion of another thread, for the purpose of better entering into and holding the wood. Screws and screw shanks are made with two or more complete threads and points, each having an incomplete thread, and all finished as a sharp point.

4,116.—BRICK AND TILE SHEDS OR KILNS: *W. Cooper.*—This patent relates to a kiln or shed for drying bricks, tiles, which has a series of arched chambers for containing the bricks to be dried, separated by hollow perforated walls opening at the top to a transverse flue leading to a chimney. Other chambers communicating to a main flue are alse used when necessary.

8,414.—FIRE-PROOF PIPES: *P. Kraus.*—I or T girders are set in a circle on an annular frame, and the cavities are filled in with material, which hardening, makes the pipe air and water tight, and increases its strength.

10,217.—LEADEN TRAPS AND PIPES: *W. W. Rosenfield* (U.S.A.).—In the manufacture of lead pipe, the pipe emerging from the press is directed into a mould around a core having the desired curve, and the pressure upon the lead causes it to assume the desired form. In S traps, two halves of this kind are soldered together to form the complete trap.

12,387.—FLAP-VALVES IN VENTILATORS: *J. Griffiths.*—The valves which are the subject of this patent are arranged to rest freely with the lower edge in a groove or box just balanced, so that impure air is permitted to flow from the apartment, but air or gases from the chimney are not permitted to pass. The valves are also practically noiseless.

NEW APPLICATIONS FOR LETTERS PATENT.

September 14.—15,528, A. Fowler, Water-closets.—15,536, H. Molyneaux, Picks.—15,550, G. Paley, Siphon-feed for supplying water to water-closets.

September 15.—15,581, E. Phillips, Boring-bits.—15,632, M. Bithorn, Sliding Double Step-ladder.—15,638, W. Bostwick, Metal Lathing.—15,645, E. Greenfield and C. Kintner, Ceiling Blocks or Roses and Cut-outs for use in connexion with electric light and other circuits.—15,656, E. Bastin, Machinery for Brick and Tile Making.

September 16.—15,681, S. Ward, Boring Wells and the like.—15,704, R. McAlpine, Construction of Dividing or Partition Walls for Dwelling-houses, &c.—15,724, A. Clay, Door-fastenings.

September 17.—15,814, J. Timmi's Metal Floors and Roofs.

September 18.—15,821, T. Pickup and J. Birtwistle, Machinery for Cutting Wood.—15,823, D. Morison, Flanges for Pipes.—15,836, D. Cameron, Suspended Combination Flush-out Water-closet Basin and Trap.—15,873, J. McCreery, Heating and Ventilation for Buildings.

September 19.—15,891, H. Stephenson, Kilns for Drying and Burning Bricks, &c.—15,901, W. Sykes, Jointing Earthenware, &c.—15,939, A. Millar, Excavating and Removing Earth and Débris.—15,940, A. Mitchell, Balustrades or Banisters.

PROVISIONAL SPECIFICATIONS ACCEPTED.

13,129, W. Gordon, Improved Door Bell.—13,484, G. Peters and S. Lucchi, Compound Fire Grates.—13,724, J. Gibson and J. Allen, Chimney-cowl.—13,825, T. Bickle, Metal Screws.—13,951, T. Harbottle, Tunnelling Apparatus.—13,983, W. Winter, Securing Moulds in the Manufacturing of Artificial Stone, Paving, and other uses.—14,043, W. Horn, Screw-driver.—14,253, A. Deacon, Tools for making Hinges.—14,539, G. Phillot, Ventilators and Chimney-cowls.—14,594, J. Bradbury, Circular Saw-benches.—14,603, J. Wild, Band-sawing Machines.—14,655, W. Horn, Saw-setting and Filing Device.—14,665, A. Brigg, Excluding the Draught through windows.—14,712, G. Couch, Window Sashes and Frames and in fittings therefor.—14,731, T. Bentley, Radiators for Warming and Heating Buildings.—14,765, E. Kleiner and others, Air Moistening and Ventilating Apparatus.—14,833, J. Pollock, Machinery or Apparatus for Carving Wood, &c.—14,877, W. Wilkinson, Composition for the Removal of Old Paint, Lacquer, &c.—14,901, J. Smith, Door-fastener.—14,918, J. Guy, Manufacture of Tiles and Bricks, and in machinery or apparatus therefor.—14,952, J. Robertson, Interlocking Impervious Brick.—14,966, J. Jones, Sash Windows.—15,041, A. Whitaker, Door and other Latches.—15,090, L. Sargent, Handle for Augers.—15,101, E. Lodge and F. Jury, Chemical Treatment or Application for Cleaning Stone, &c.—15,112, R. Richards, Fastening Device for Holding Window Casements, &c., and other hinged articles in any suitable open or closed position.—15,210, H. Warrington, Ovens or Kilns for Burning Porcelain, Bricks, Tiles, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

18,382, J. Woodward, Wearing Surface of Stair-treads, &c. 18,725, S. Ward, Flush-cisterns. 18,768, A. Smith, Exhaust Ventilator and Chimney-pot. 10,648, W. Gedge, Sash-balances.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

SEPTEMBER 22.—By *J. N. Goatly*: 1 and 2, Creffield-rd., Ealing, u.t. 88 yrs., g.r. 15*l.*, r. 150*l.*, 1,440*l.*; the residence, "Eversley Lodge," u.t. 88 yrs., g.r. 20*l.*, r. 110*l.*, 1,130*l.*—By *Fuller & Fuller*: "Hope Villa," Birkbeck-rd., Beckenham, f., r. 24*l.*, 170*l.*; 9, 11, and 16, Grove-ter., Tottenham, u.t. 85 yrs., g.r. 24*l.* 3s., r. 101*l*, 395*l.*; a freehold house and carpenter's shop, Station-rd., Bexley Heath, r. 14*l.* 10s., 200*l.*—By *Humbert, Son, & Flint* (at Watford): 1 and 2, Cambridge-villas, Croxley-green, Herts, f., r. 35*l.* 2s., 440*l.*; "The Wellington Arms," Woodford-rd., Watford, f., 3,560*l.*; a plot of freehold land, St. John's-rd., 650*l.*; "The Rose and Crown Estate," 9 plots of freehold land, 798*l.*—By *Bean, Burnett, & Co.*: F.g.r. of 15*l.*, with reversion in 88 yrs., Millfield-rd., Clapton, 280*l.*

SEPTEMBER 23.—By *A. Savill & Son*: A tithe rent-charge of 299*l.* 16s. a year, Barking, 3,200*l.*—By *D. Young*: 18, St. Martin's-rd., Stockwell, u.t. 70 yrs., g.r. 5*l.* 5s., 270*l.*; l.g.r. of 16*l.* 16s., u.t. 20 yrs., Lilford-rd., Camberwell, 180*l.*; 56 to 75, Aldred-rd., Kennington, u.t. 46 yrs., g.r. 95*l.*, 3,765*l.*; l.g.r. of 59*l.* 8s., u.t. 31 yrs., Loughborough-pk., Brixton, 910*l.*; 48 and 50, Loughborough-pk., u.t. 31 yrs., g.r. nil, r. 100*l.*, 980*l.*—By *J. J. Deverell & Co.*: 2, Park's-ter., Tottenham, f., r. 28*l.*, 450*l.*—By *H. J. Bliss & Sons*: 245 to 253 odd, Brick-lane, Bethnal-green, u.t. 16 yrs., g.r. 60*l.*, 210*l.*; 5 and 7, Gossett-st., u.t. 21 yrs., g.r. 25*l.*, r. 53*l.* 6s., 51*l.*; 2 to 16 even, Gossett-st., u.t. 21 yrs., g.r. 160*l.*, r. 191*l.* 2s., 30*l.*; 12, 14, and 16, Chambord-st., u.t. 21 yrs., g.r. 50*l.*, r. 104*l.* 16s., 30*l.*; 62 and 64, Virginia-rd., and 1 to 6, New-st., u.t. 13 yrs, g.r. 150*l.*, 150*l.*; 19, Woodfield-pl., Paddington, u.t. 71 yrs., g.r. 5*l.* 10s., r. 34*l.*, 315*l.*; 130, Provost-st., Hoxton, u.t. 11 yrs., g.r. 3*l.* 10s., r. 28*l.* 12s., 76*l.*; 1 and 3, Monteith-rd., Old Ford, f., r. 46*l.* 16s., 400*l.*; 17 and 19, Monteith-rd., f., r. 46*l.* 16s., 400*l.*; 54, Beulah-rd., Walthamstow, f., r. 29*l.*, 300*l.*; "Wallwood Cottage," Hainault-rd., Leytonstone, f., 450*l.*; 3 to 6, James-pl., and 7, Jacobine-st., Haggerston, u.t. 57 yrs., g.r. 18*l.*, 100*l.*; 1 and 3, Camden-st., Bethnal Green, f., r. 59*l.* 16s., 530*l.*—By *Jackson & Co.* (at Romford): "The Old Market House," High-st., Ongar, f., r. 21*l.*, 230*l.*; a freehold house and shop, r. 9*l.*, 112*l.*; 5 acres freehold land, Navestock, Essex, 130*l.*; four freehold cottages and granary, 100*l.*; a plot of freehold land, about 2 acres, 65*l.*; an enclosure of freehold land, 3a. 3r. 8p., 110*l.*

SEPTEMBER 24.—By *Stimson & Sons*: 10 and 12, Dagmar-rd., Croydon, f., r. 50*l.*, 590*l.*; 16 and 17, Branksome-rd., Brixton, u.t. 75 yrs., g.r. 10*l.*, r. 65*l.*, 380*l.*; 58 and 60, Cranham-rd, Bermondsey, u.t. 65 yrs., g.r. 7*l.*, r. 52*l.*, 300*l.*; 38, Leipsic-rd., Camberwell, u.t. 14 yrs., g.r. 4*l.*, 140*l.*; 66, Wood-st., Woolwich, u.t. 14 yrs., g.r. 2*l.* 15s., r. 18*l.*, 130*l.*—By *C. C. & T. Moore*: "St. Peter's Lodge," Talbot-road, Tottenham, f., r. 50*l.*, 750*l.*; 83, St. Thomas-rd., Victoria Pk., u.t. 62 yrs., g.r. 6*l.*, 355*l.*; 9, 11, and 13, Norris-rd., Bromley-by-Bow, u.t. 70 yrs., g.r. 8*l.* 10s., 350*l.*; 1, Annie-ter., Silvertown, f., 160*l.*—By *Farebrother, Ellis, & Co.*: 8 to 11, Little Newport-st., Soho, f., r. 200*l.*, 3,320*l.*; 12 and 13, Little Newport-st., and 20 and 20½, Newport-ct., f., r. 150*l.*, 2,470*l.*; 10, Montague-pl., Russell-sq., u.t. 10 yrs., g.r. 40*l.*, r. 155*l.*, 490*l.*; 25, Upper Montagu-st., and 25A and 25B, Crawford-st,, Marylebone, u.t. 15½ yrs., g.r. 20*l.*, 420*l.*

SEPTEMBER 25.—By *G. J. Healy*: The Wigan Tramways, including plant and premises, near Wigan, 4,500*l.*—By *J. Revell*: 49 and 51, Crofton-rd., Camberwell, u.t. 75 yrs., g.r. 12*l.* 12s., r. 64*l.*, 550*l.*

[*Contractions used in these lists.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; l.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard, &c.]

PRICES CURRENT OF MATERIALS.

TIMBER.		
Greenheart, B.G. ton	8/0/0	9/0/0
Teak, E.I... load	8/0/0	14/0/0
Sequoia, U.S.ft.cu.	2/3	3/0
Ash, Canada load	2/5/0	4/0/0
Birch, do.	2/5/0	4/5/0
Elm, do.	3/5/0	4/15/0
Fir, Dantsic, &c.	2/0/0	3/10/0
Oak, do.	2/10/0	4/10/0
Canada.....	4/17/6	6/10/0
Pine, Canada red	2/10/0	3/10/0
Do. yellow ...	2/0/0	5/0/0
Lath, D'ntsic, fath	5/0/0	6/0/0
St. Petersburg	5/0/0	7/0/0
Deals, Finland, 2nd & 1st std 100	8/0/0	10/0/0
Do, 4th & 3rd..	7/10/0	8/10/0
Do. Riga	6/10/0	8/0/0
St. Petersburg, 1st yellow ..	10/0/0	14/0/0
Do. 2nd yellow	8/10/0	9/10/0
Do. white	7/0/0	10/0/0
Swedish	7/0/0	15/10/0
White Sea	8/10/0	17/0/0
Canada, Pine 1st	13/0/0	25/0/0
Do. do. 2nd....	9/0/0	18/0/0
Do. do. 3rd, &c.	6/10/0	10/0/0
Do. Spruce. 1st	8/0/0	10/10/0
Do. do. 3rd & 2nd.....	6/0/0	7/15/0
New Brunswick	5/10/0	7/10/0
Battens, all kinds	3/10/0	15/10/0
Flooring Boards, sq., 1 in. prep. 1st	0/8/0	0/14/0
Do. 2nd.....	0/7/6	0/11/0
Other qualities	0/3/0	0/8/0
Cedar, Cuba ..ft.	/4	/4½
Honduras, &c.	/4	/4½
Mahogany, Cuba.	/4½	/0
St. Domingo, cargo av	/4½	/6½
Mexican do. do	/4½	/5
Tobasco do. do	/5½	/7
Honduras do..	/5½	/6½
Box, Turkey ton	4/0/0	13/0/0
Rose, Rio.....	10/0/0	20/0/0
Bahia	9/0/0	18/0/0
Satin, St. Domingo ....ft.	0/0/9	0/1/3

TIMBER (*continued*).		
Satin, Porto Rico	0/0/10	0/1/6
Walnut, Italian..	0/0/3½	0/0/7
METALS.		
IRON—Pig, in Scotland .....ton	47/5/0	47/6/0
Bar, Welsh, in London.....	6/0/0	6/2/6
Do. do. at works in Wales	5/10/0	5/12/8
Do. Staffordshire, in London	6/10/0	6/15/0
COPPER—British, cake and ingot	54/10/0	55/0/0
Best selected ..	55/10/0	56/0/0
Sheets, strong..	66/0/0	0/0/0
Chili, bars	52/5/0	52/12/6
YELLOW METAL lb.	0/0/5½	0/0/6½
LEAD — Pig, Spanish ....ton	12/5/0	0/0/0
English, com. brands	12/7/6	12/10/0
Sheet, English, 3 lbs. per sq. ft. and upwards ..	14/5/0	0/0/0
Pipe	14/15/0	0/0/0
ZINC — English sheet .....ton	27/10/0	0/0/0
Vieille Montagne.....	28/0/0	0/0/0
TIN—Straits	91/7/6	91/17/6
Australian	92/12/6	93/2/6
English Ingots	94/0/0	95/0/0
OILS.		
Linseed .....ton	19/15/0	20/0/0
Cocoanut, Cochin	29/10/0	0/0/0
Do. Ceylon	25/5/0	25/10/0
Palm, Lagos	25/5/0	25/10/0
Rapeseed, English pale	30/15/0	0/0/0
Do. brown	29/0/0	29/5/0
Cottonseed ref..	19/15/0	20/0/0
Oleine	0/0/0	0/0/0
Lubricating, U.S.	4/10/0	5/10/0
Do. refined	6/0/0	11/0/0
TAR—Stockholm barrel	0/18/6	0/19/0
Archangel	0/12/0	0/12/6

TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *noon on Thursdays.*]

BANFF.—Accepted for the erection of a dwelling-house, Cast'e-treet, Banff, for Mr. Milne. Mr. G. Sutherland, architect, Elgin:—

Wm. Alexander & Sons, Builders, Macduff.....	£700 0 0
Jas. Sellar, Carpenter, Banff	
A. Strachan, Plumber, Banff	
H. Hutchison, Plasterer, Banff	
J. McIntosh, Slater, Banff.....	
Roger & Company, Painters, Banff	

BANFF.—For erecting a villa residence, for Mr. J. Rankins. Mr. G. Sutherland, architect, Elgin:—

Wm. Lawrence, Mason, Banff	£900 0 0
J. Sellar, Carpenter, Banff	
Thomson & Co., Plumber, Banff	
J. Brodie, Plasterer, Elgin	
J. McIntosh, Slater, Banff	
A. Chalmers, Painter, Banff	

CROYDON.—For alterations and additions at Northcote, Duppas-hill, Croydon:—

B. E. Nightingale.....	£338 0 0
McCormick & Sons, Canonbury-road (accepted) ..	325 0 0

DEVONPORT.—For alterations, repairs, and painting of landing stage at Northcorner, for the Corporation of Devonport. Mr. J. F. Burns, Borough Surveyor, Devonport:—

Willoughby Bros	£192 0	Ellacott, Plymouth*	£119 10
C. L. Duke.....	120 0	* Accepted.	

DEVONPORT.—For wood-paving a portion of the carriage-way, Chapel-street, Devonport, for the Corporation of Devonport. Mr. J. F. Burns, Borough Surveyor, Devonport:—

T. Shaddock	£406 5	J. T. Shepherd	£291 19
Shaddock Bros.....	396 0	C. L. Duke	287 0
Parsons & Sons	374 12		

[All of Plymouth.]

EASINGTON-LANE (co. Durham).—For works in connexion with the formation of a new cemetery at Easington-lane, comprising sub-soil drainage and roadways, boundary-walls, iron palisading and drainage castings, caretaker's lodge, from plans prepared by Mr. D. Balfour, M. Inst. C.E, 3, St. Nicholas-buildings, Newcastle-on-Tyne:—

Thomas Dixon.....	£2,205	R. Hudson, jun., St. Mark's Lodge, Sunderland *	£2,050
John Carrick	2,201		
J. T. Simpson	2,153	* Accepted.	

EAST FORDINGTON (Dorset).—Accepted for the erection of a Wesleyan Mission Chapel. Mr. T. Dibben, architect:—

R. Davis & Son, Dorchester	£396 17 2

GUILDFORD.—For alterations and additions to the "Royal Arms" Coffee Tavern, Guildford, for the Working Men's Institution. Mr. A. J. Sturges, architect, Guildford:—

T. Davies.....	£740 10	R. Wood	£609 0
P. C. May	735 0	Higlett & Hammond	609 0
G. Strudwick.....	635 0	R. Smith.....	597 0
S. Ellis.....	620 0	Smith & Sons (accepted)..	560 0

HASTINGS.—For rebuilding the "Kicking Donkey" public-house, Hastings, for Messrs. Chapman & Sons. Mr. H. Ward, architect, 8, Bank-buildings, Hastings:—

P. Jenkins.....	£623	W. E. Warman	£540
H. Ditch.....	610	C. Harman	540

HASTINGS.—For alterations and repairs to Holmwood Lodge, Hastings, for Miss Lorris. Mr. G. F. Burn, architect, Havelock-road, Hastings:—

Bishop	£129 13	W. C. Warman.....	£121 1
Millen & Son	125 15	Hills.....	120 0

KEITH.—Accepted for relaying the flooring of the church of Keith, for the Heritors of Keith. Mr. F. D. Robertson, architect, 92, Mid-street, Keith. Quantities by the architect:—

Mason—Wm. McPherson, Fife Keith.....	£31 10 0
Carpenter—Wm. McCormachie, Fife Keith	70 0 0
Heating Engineer—Robert Tindall, Aberdeen	9 15 0
Total	£111 5 0

[Architects estimate, £120.]

KEYSWORTH (Dorset).—For the erection of a pair of labourers' cottages at Keysworth Farm, for Mrs. S. C. E. Erule Erle-Drax. Mr. W. Watts Fookes, architect and surveyor, Wareham:—

Alfd. Knight	£401	George Hobbs (accepted)....	£370
D. Hitching	380		

KINETON (Warwickshire).—For erecting new school buildings, Kineton. Mr. Francis Trepess, architect, Warwick. Quantities not supplied:—

Fleming	£1,250	Hancock, Kineton*	£860
Kibler.....	948	Talliss.....	780
		* Accepted.	

LEOMINSTER.—Accepted alterations, additions, and fittings to new bank premises at Broad-street, for the Birmingham District and Counties Banking Co. Messrs. Thomason & Whitwell, architects, Temple-street, Birmingham:—

H. Millward, Leominster	£515 0 0

LEOMINSTER.—Accepted for the erection of two semi-detached villa-residences, Leominster, for Mrs. Theodore Nield, Manchester:—

H. Millward, Leominster	£1,450 0 0

LEOMINSTER.—For alterations and additions to premises, South-street, Leominster, for proposed free library. Mr. F. R. Kempson, architect, Bromyard:—

C. Edwards.....	£944 0 0
H. Millward, Leominster (accepted).....	927 10 0

LEOMINSTER.—Accepted for the erection of house, Buckfields, Leominster, for Mr. Tom Vale (exclusive of painting, grates, &c.). Mr. Geo. Smith, architect:—

H. Millward, Leominster	£425 0 0

LEOMINSTER.—Accepted for the erection of villa-residence, Almeley, for Miss Southall:—

Private Contract.

H. Millward, Leominster	£450 0 0

LLANYRE.—For the erection of a parsonage house and offices at Llanyre, near Llandrindod, for the Rev. J. P. Morgan. Messrs. W. & T. Williams, architects, Brecon. Quantities by Mr. Thomas Williams:—

J. B. Williams.....	£2,150	Price & Deakins	£1,963
Williams & Sons.....	2,000	Alfred Meredith.....	1,889
B. A. Hamer	1,973	B. Jenkins	1,680

LONDON.—For new counter and pewtering work at "The Jolly Gardeners," Lambeth-walk, for Mr. J. H. Heil. Mr. R. A. Lewcock, architect and surveyor, 88, Bishopsgate-street Within:—

Heath	£235 0	Saunders	£206 19
Helling	224 0	H. & F. Warne*	205 19
		* Accepted.	

LONDON.—For alterations, repairs, and redecorating the "Weavers' Arms," Newington-green-road, N., for Mr. Strong:—

Hignell	£967	Burton & Sons.....	£710
Dearing & Son.....	887	Henry.....	700
Sheffield Bros.....	843		

LONDON.—For alterations and extension to Nos. 158-160, Stroud-green-road, Hornsey, for Mr. W. King. Mr. George Carter, architect and surveyor, 513, Holloway-road:—

Macfarlane Bros.	£480	Stevens Bros. (accepted)	£425

LONDON.—For alterations and additions to "The Princess Royal" public-house, Hereford-road, Bayswater, for Mr. W. C. Brown. Messrs. Wylson & Long, architects, 15, King William-street, W.C. No quantities supplied:—

C. F. Kearley	£3,314	Frank Kirk	£2,770
Gould & Brand.....	3,293	Robert Eddie	2,397
Wm. Oldrey & Co.....	3,061	T. L. Green	2,276

LONDON.—For the erection of a block of residential flats to be called "Cheyne Court," Chelsea. Mr. Fred. Hemings, architect, Ingram House, 165, Fenchurch-street:—

H. Johnson, Wood Green (accepted)	£46,000 0 0

LONDON.—For new drainage and other works, at 6, Gloucester-place, Hyde-park, for Mr. D. H. Marrable. Messrs. Brown & Pritchett, architects, Limpsfield, Surrey:—

J. H. Jolliffe	£320 0 0
G. Arthur, Kentish Town (accepted)	290 0 0

LONDON.—For new drainage and other works at 42, Ladbroke-road, W., for Mrs. Marrable. Messrs. Brown & Pritchett, architects, Limpsfield, Surrey:—

J. H. Jolliffe, Kensington (accepted)	£132 0 0

LONDON.—For additions to No. 30, Finsbury-square. Mr. C. A. Winter, architect, 19, Finsbury-pavement:—

J. H. Mollett	£763	Jones & Groves	£590
Hunt	724	Neil	577
Rowe Bros.	695	Edwards	525
Kennick	660	Blandford	495
Malvin	630	Lovell & Co.....	483
Chinchin	620	Lukes & Hooker	465
Minter	598	Channing	459

LONDON.—For structural repairs to the church of St. Mary-le-Bow, Cheapside. Mr. C. Innes, architect, 27, Queen-street, E.C.:—

Macey & Son.....	£1,130	Dove Bros.	£845
Prestige & Co.....	920		

LONDON.—For the enlargement of the head offices of the School Board for London. Mr. R. Edis, Architect:—

Messom	£49,750	Higgs & Hill, South Lambeth-road*	£46,940
Boyce	47,620		
Foster & Dicksee	47,161	Lawrance & Son	46,803

* Accepted by the Works Committee.

LONDON.—For the erection of a school to provide accommodation for 805 children, Kemsing-road, Halstow-road, Greenwich, for the School Board for London. Mr. T. J. Bailey, Architect:—

		If brickwork be built in cement add:
Hobbs & Co., Limited	£18,406	£243
H. Lovatt	19,198	331
S. & W. Pattinson.....	18,030	221
Holloway Bros.	17,310	460
Treasure & Son	16,753	147
W. H. Lorden & Son, Upper Tooting	16,440*	441*
Kirk & Randall	16,354	406

* Accepted by the Works Committee.

LONDON.—For the erection of a school to provide accommodation for 803 children, Grove-street, Deptford, for the School Board for London. Mr. T. J. Bailey, Architect:—

Willmott & Sons	£19,627	Hobbs & Co, Limited ..	£17 540
W. Downs	18,049	Treasure & Son	16,999
Killby & Gayford	18,020	Hart Bros., Great Dover-street, S.E.*	16,947
Kirk & Randall	17,879		
Holloway Bros.	17,808		

* Accepted by the Works Committee.

LONDON.—For the erection of a school to provide accommodation for 803 children, Bird-in-the-Bush-road, Peckham, for the School Board for London. Mr. T. J. Bailey, Architect:—

			If brickwork be built in cement add.
Killby & Gayford	£17,864	....	£329
Foster & Dicksee	17,764	....	352
H. Lovatt.....	17,621	....	425
Lathey Bros.	16,783	....	447
Treasure & Son	16,758	....	276
Hobbs & Co., Ltd.....	16,634	....	381
Hart Bros.	16,567	....	325
Holloway Bros., Victoria Works, Battersea	16,367*	....	436*

* Accepted by the Works Committee.

LONDON.—For the enlargement of school, Holmes-road, Kentish Town, by 511 places, and for carrying out improvements to existing school, for the School Board for London. Mr. T. J. Bailey, Architect:—

			If brickwork be built in cement add
Gregar & Son	£17,498	0 0	£339 0 0
Willmott & Sons	17,375	0 0	375 0 0
Holliday & Greenwood ..	16,983	0 0	293 0 0
Foster & Dicksee	16,705	0 0	182 0 0
Grover & Son	16,427	0 0	275 0 0
F. J. Coxhead.....	16,213	10 10	248 19 4
C. Cox	16,100	0 0*	280 0 0*

* Accepted by the Works Committee.

LONDON.—For alterations and improvements to the Orchard-street school, Hackney, for the School Board for London. Mr. T. J. Bailey, Architect:—

			If brickwork be built in cement add.
Garrett & Son.....	£3,050	0	£20 0
G. J. Kick	2,731	6	— 0
W. Neil.....	2,672	0	25 0
T. McCormick & Sons, Canonbury-road	2,549	0*	10 0*

* Accepted by the Works Committee.

LONDON.—For new shop front and fittings, at 225, Regent-street, for Mr. G. Whight. Mr. M. V. Treleaven, architect, 18, Acre-lane, Brixton, S.W.:—

Reid	£516 0	Sumner	£368 10
Crabe	456 0		

LONDON.—For shop front, &c., at Goldhurst-terrace, N.W., for Mr. Findlay. Mr. F. Wallen, architect, 96, Gower-street, W.C.:—

Drew & Cadman.....	£261	Sumner	£194

LONDON.—For shop front and complete fittings, at Fitzjohn's Promenade, N.W., for the South Hampstead Toilet Company, Limited. Mr. M. V. Treleaven, architect, 18, Acre-lane, Brixton, S.W.:—

Clarke	£833 19	Fright	£775 10
Sprinks	813 0	Sumner (accepted)	769 0

LONDON.—For the enlargement of the Norwood Schools Infirmary, for the Guardians of the Parish of Lambeth. Mr. S. R. J. Smith, architect, 15, York-buildings, Adelphi :—

Allen & Sons	£2,650	Carthy	£2,275
Adams	2,459	Wallis	2,236
Holland	2,397	Acres	2,195
Nightingale	2,394	Summerford	2,182
Stevens	2,358	Jackson	2,095
Higgs	2,350	Deacon*	2,021
Waddington	2,292		

* Accepted.

MIDDLETON (near Manchester).—For erecting a drill-hall at Middleton, Manchester. Mr. T. A. Fitton, architect, Middleton. Quantities by the architect :—

T. Jackson	£1,658	J. R. Mellalieu	£1,599
R. Robertson	1,650	W. Pollitt	1,595
J. Simpson	1,640	J. Briscam	1,590
J. T. Dempsey	1,630	E. Partington & Sons*	1,588
J. Bromley	1,625		

* Accepted.

MORLEY.—For the erection of a house and shop at the junction of South Queen-street and Fountain-street, Morley, for Mr. Hartley. Mr. T. A. Buttery, architect, Queen-street, Morley. Quantities by the architect :—

Mason and Bricklayer.—George Johnson, Morley.	£232	10	0
Joiner's Work.—John Wass, Morley	197	0	0
Plumber's Work.—G. A. Firth, Morley	74	15	0
Plasterer's Work.—Ed. Wilson, Morley	29	15	0
Slater's Work.—John Atkinson & Son, Leeds	23	8	0
	£557	8	0

NEWPORT (Mon.).—For erecting business premises, No. 80, Commercial-road, for Mr. C. Jenkins. Mr. Alfred Swash, architect and surveyor, Newport :—

T. Webb	£1,529	Moulton & Brownscombe	£1,458
Morgan & Roberts	1,526	W. Blackburn	1,449
W. Price	1,500	W. A. Linton, Hereford-place, Newport*	1,433
J. Linton	1,486		
W. Jones & Son	1,477		

* Accepted.

NEWPORT (Mon.).—For rebuilding "Isca Inn," Commercial-street, for Messrs. Phillips & Sons. Mr. Alfred Swash, architect and surveyor, Newport :—

W. M. Blackburn	£1,197	T. Webb	£1,095
W. A. Linton	1,120	W. Jones & Son	1,087
J. Hooper	1,100	E. Richards, Price-street*	1,079

* Accepted.

NEWPORT (Mon.).—For erecting business premises, No. 44, Commercial-street, and warehouses (exclusive of girders and smiths' work), for Mr. Roland Alger. Mr. Alfred Swash, architect and surveyor, Newport :—

E. Richards	£985	J. Hooper	£870
J. Linton	960	T. G. Diamond, Charles-street (accepted)	856
Moulton & Brownscombe	920		

NEWPORT (Mon.).—For business premises, No. 81, Commercial-road, for Mr. W. Leahy. Mr. Alfred Swash, architect and surveyor, Newport :—

T. G. Diamond	£927	E. Richards	£769
W. Blackburn	860	W. A. Linton, Hereford place, Newport*	750
J. Hooper	821		
P. McCarthy	797		

* Accepted.

NEWPORT (Mon.).—For business premises, No. 115, Commercial-street, for Messrs. Gabb & Son. Mr. Alfred Swash, architect and surveyor, Newport :—

John Linton	£896	W. Blackburn	£837
J. W. Parfitt	880	Moulton & Brownscombe	835
T. G. Diamond	850	E. Richards, Price-street*	795

* Accepted.

NUTFIELD.—For addition to Woolpits, for Mr. J. E. De Vesian Messrs. Brown & Pritchett, architects, Limpsfield, Surrey :—

English	£560 17 0
G. Arthur, Kentish Town (accepted)	475 0 0

PLASHET (Essex).—For alterations to the Girls' and Infants' Departments at the Industrial Schools, Plashet, Essex, for the Guardians of Saint George-in-the-East. Messrs. Wilson, Son, & Aldwinckle, architects, 1, Victoria-street, Westminster S.W. :—

T. Brightmore	£520 0	J. Holland	£484 0
T. White & Son	485 14		

RICHMOND.—For alterations and additions to "Faircroft," King's-road, Richmond, Surrey, for Mr. P. Steinmann. Mr. W. J. Wood, architect, 1, Finsbury-circus, E.C. Quantities by Messrs. Bushell & Crosier, 1, Finsbury-circus, E.C. :—

Parslow	£630 17 6	Lansdown & Co.	£614 0 0
Jarvis	630 0 0	Piller & Son	527 0 0
Lillywhite & Co.	620 0 0	T. Sayers, Brockley*	460 0 0

* Accepted.

SOUTHEND-ON-SEA.—For the erection of house and offices at Southend-on-Sea, for Dr. Morris. Mr. W. J. Wood, architect, Southend. Quantities by Messrs. Bushell & Crosier, 1, Finsbury-circus, E.C. :—

Whur	£1,318	Woodhams	£1,262
West	1,263	Dupont	1,249
Darke	1,293	Gozzett	1,246
Baker & Wiseman	1,267		

TOTNES.—For alterations to stabling and outbuildings at the "Seven Stars" Hotel, for Mr. J. Templeton. Mr. W. M. Tollit, architect. Quantities supplied :—

F. Vanstone	£333	Reeves & Selwood	£274
Goodridge & Toope	286	Rabbich & Brown, Paignton*	250

* Accepted.

WARRINGTON.—Accepted for the erection of new chapel, Warrington. Mr. R. Parry, architect, 10, Grandidge-street, Rochdale. Quantities supplied by the architect :—

Thos. Spencer, 7, Union-street, Southport £825 0 0

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IV.	Peterborough ,,	*A. Mitchell*	April 4.
V.	Wells ,,	*R. W. Paul*	May 2.
VI.	Exeter ,,	*A. N. Wilson*	June 6.
VII.	Salisbury ,,	*The Editor*	July 4.
VIII.	Bristol ,,	*R. W. Paul*	Aug. 1.
IX.	Norwich ,,	*S. K. Greenslade*	Sept. 5.
X.	Rochester ,,	*H. W. Brewer*	Oct. 3.
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Design for Restoration of the Great Screen, Winchester Cathedral.
Chancel Screen, St. Mary's, Stamford.
Design for Decorative Altar in Electrotype or Beaten Metal.
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Sketch for a Credence Table.

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New Classes established in connexion with the Carpenters Company.
An Afternoon Class for Architectural Drawing, and an Evening Class for Building Construction and Drawing, each meeting twice a week, will commence OCTOBER 13th.
For particulars, see the syllabus, to be obtained at University College, Gower-street, W.C.
J. M. HORSBURGH, M.A.
Secretary.

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1 day per week	1 Guinea.
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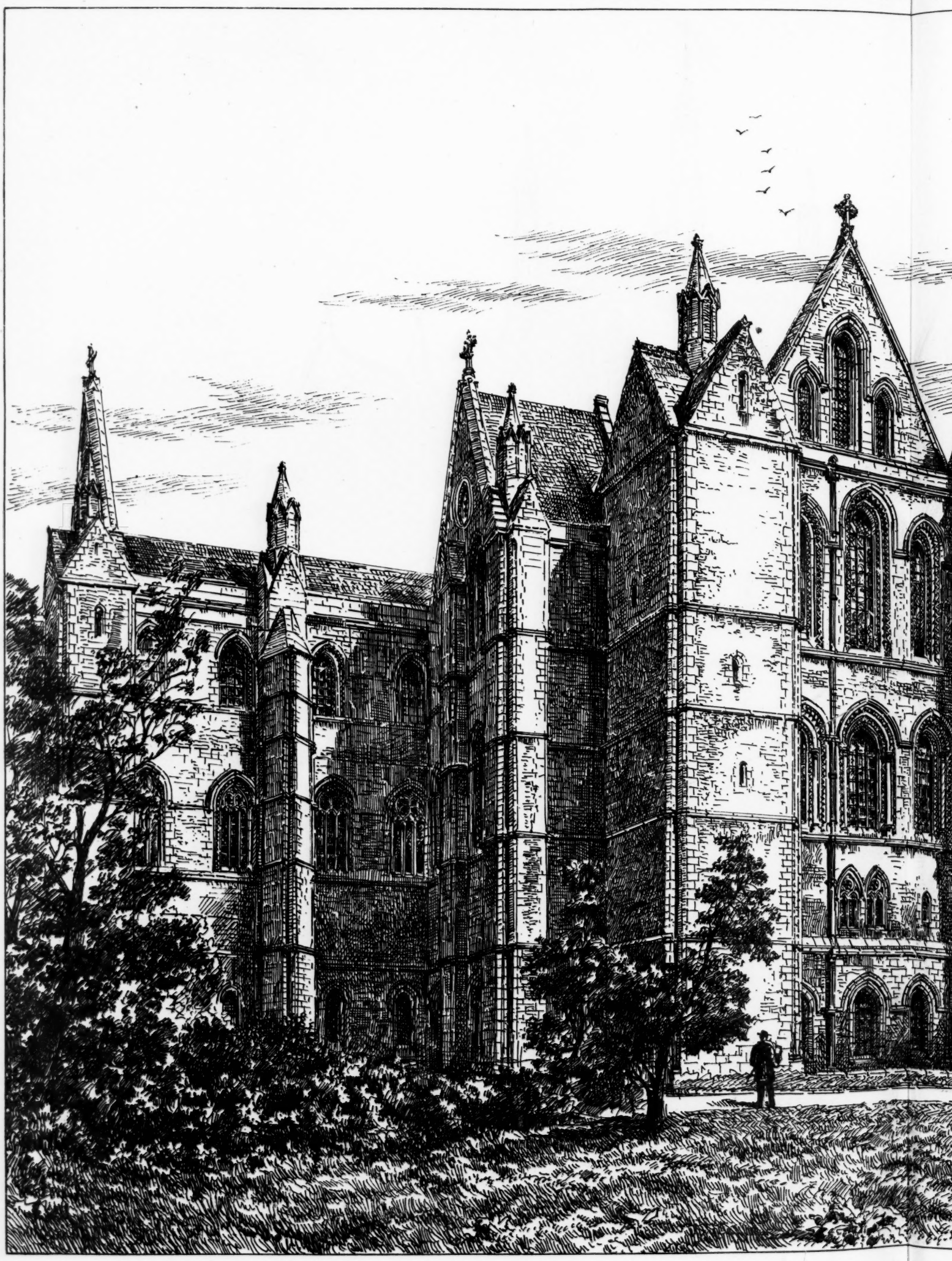
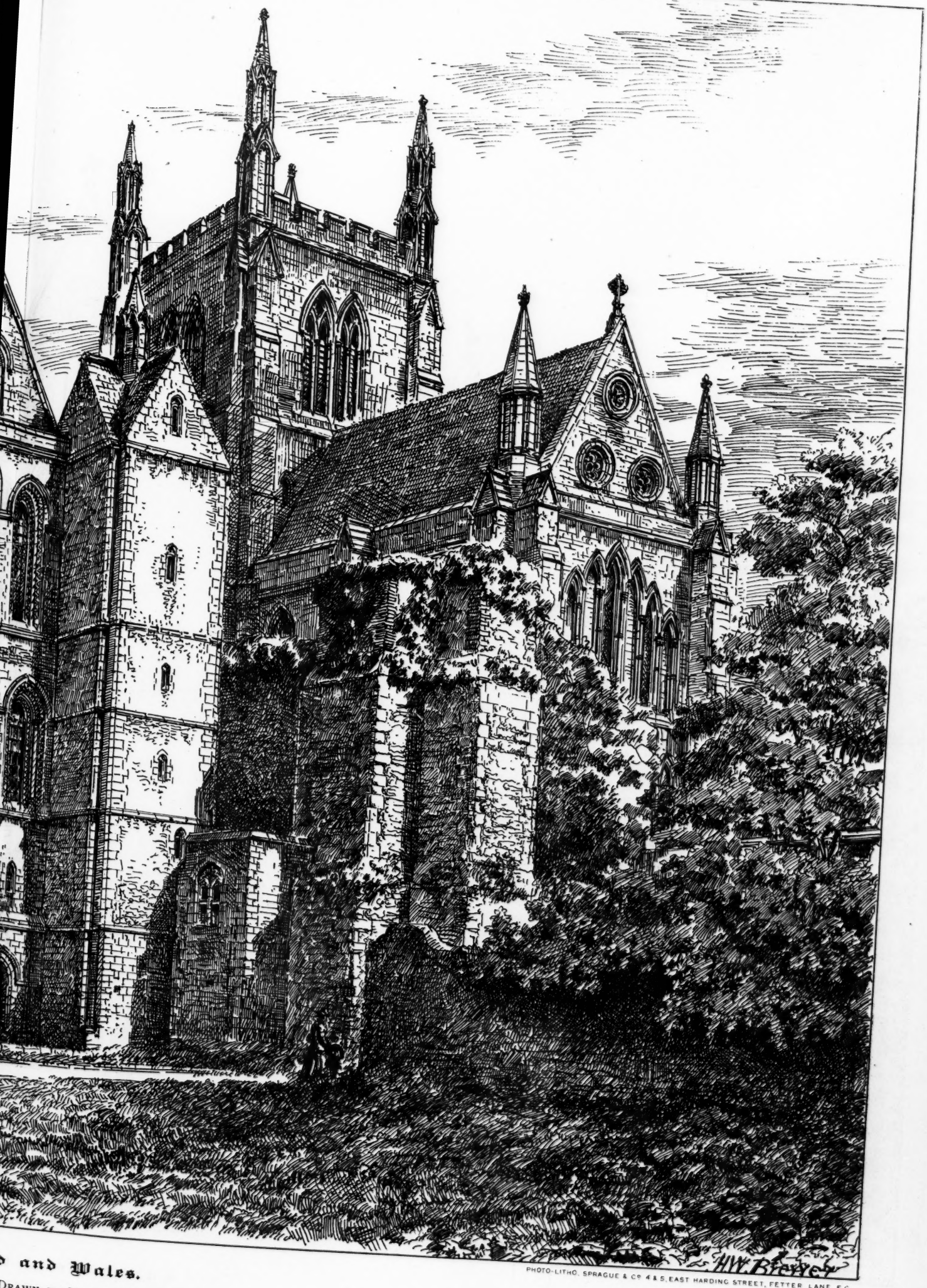
Students nominated by the Carpenters' Company are admitted at half-fees to the Day Classes.
Students are provided with tools free for their first term, and prizes are offered by the Company every year, the sum of 23*l.* having been thus awarded in July last.
Arrangements have been made by which Ladies are permitted to attend.
Next Term will commence on MONDAY, OCTOBER 5th, 1891.
Further particulars may be obtained of the Carpenters' Company, London-wall, E.C.; or of the Secretary, at King's College, Strand, W.C.



Cathedrals of England

No. 10. ROCHESTER: FROM THE EAST.—Dr.



d and Wales.

DRAWN BY MR. H. W. BREWER.

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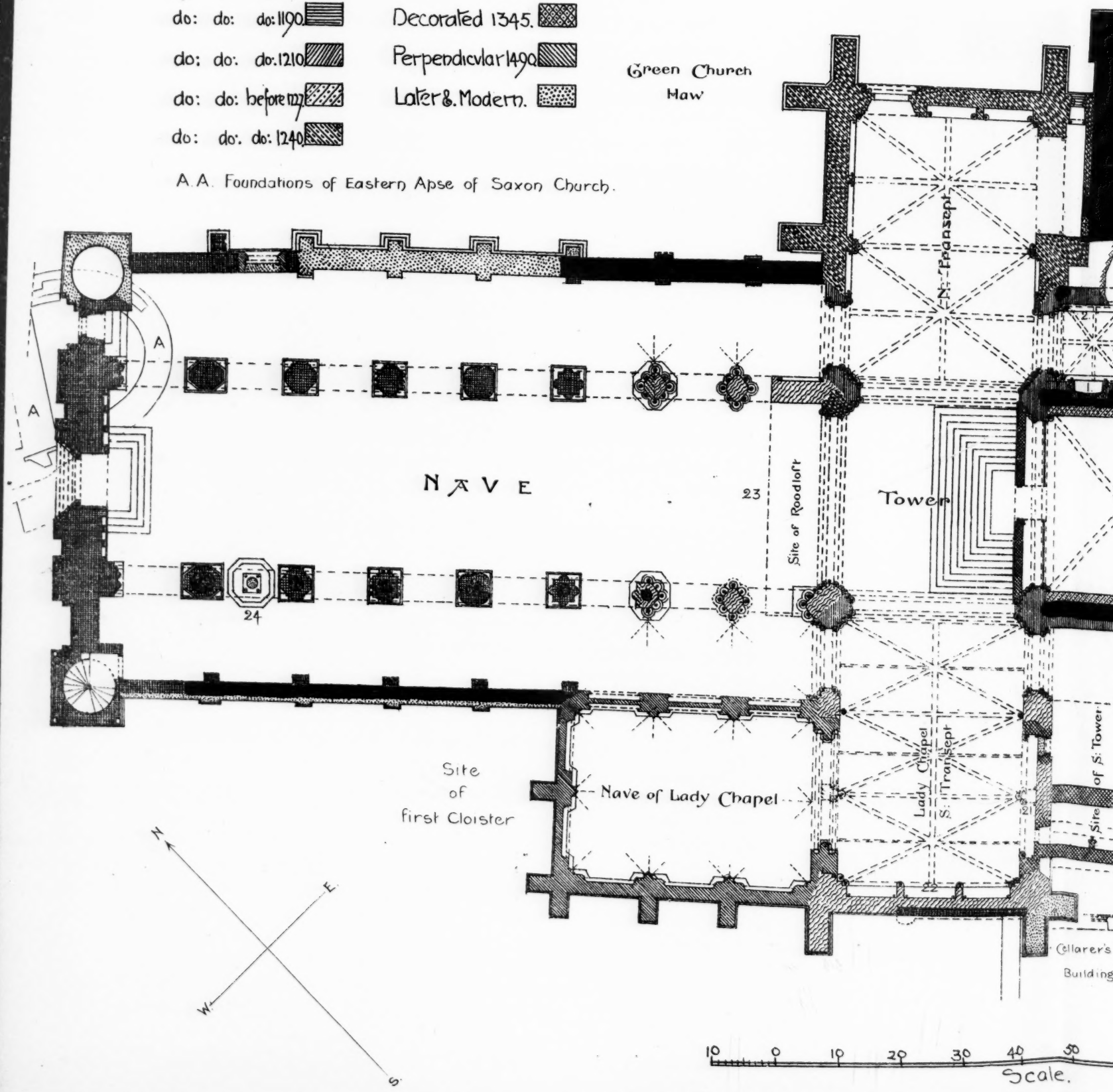
ROCHESTER CATHEDRAL.

GROVND-PLAN.

Dates.

Early Norman 1080	Early Decorated 1280.
Later do: 1115.	do: do: 1300.
Early English after 1179	do: altns & addns.
do: do: do: 1190.	Decorated 1345.
do: do: do: 1210.	Perpendicular 1490.
do: do: before 1179	Later & Modern.
do: do: do: 1240.	

A.A. Foundations of Eastern Apse of Saxon Church.



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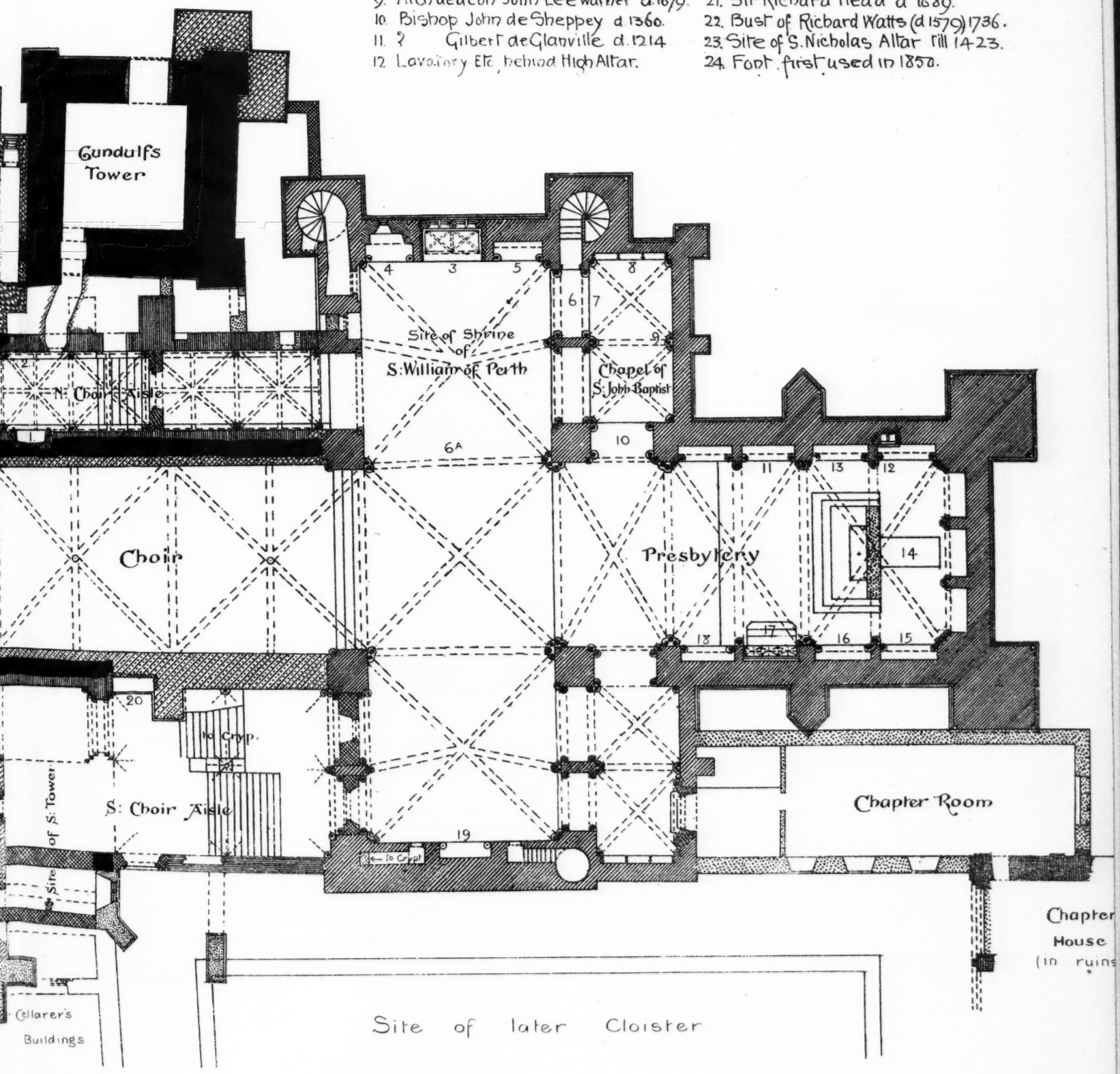
Reference to Monuments, Etc..

1. Bishop Hamo de Heythe . d1352.
2. William Streaton & wife, 1609.
3. Bishop Walter de Merton, d. 1277.
4. Elizabethan Effigy of Walter de Merton.
5. Tomb of a Prior.
6. Bishop John Lowe d. 1467. (formerly at 6A)
7. John Warner Esq , 1698.
8. Bishop Warner, d. 1666.
9. Archdeacon John Lee Warner d. 1679.
10. Bishop John de Sheppey d. 1360.
11. ? Gilbert de Glanville d. 1214
12. Lavatory Etc, behind High Altar.
13. Bishop Laurence de S. Martin, d1274.
14. Sir Wm Arundel, K.G. d 1400 & Lady.
15. Coffin assigned to Bishop Gundulf d. 1108.
16. Bishop Thomas de Ingoldsthorpe d. 1291.
17. Sedilia.
18. Coffin lid lately removed from Crypt.
19. Unknown Tomb.
20. Bishop John de Bradfield d. 1283.
21. Sir Richard Head d 1689.
22. Bust of Richard Watts (d 1579) 1736.
23. Site of S. Nicholas Altar till 1423.
24. Font, first used in 1858.



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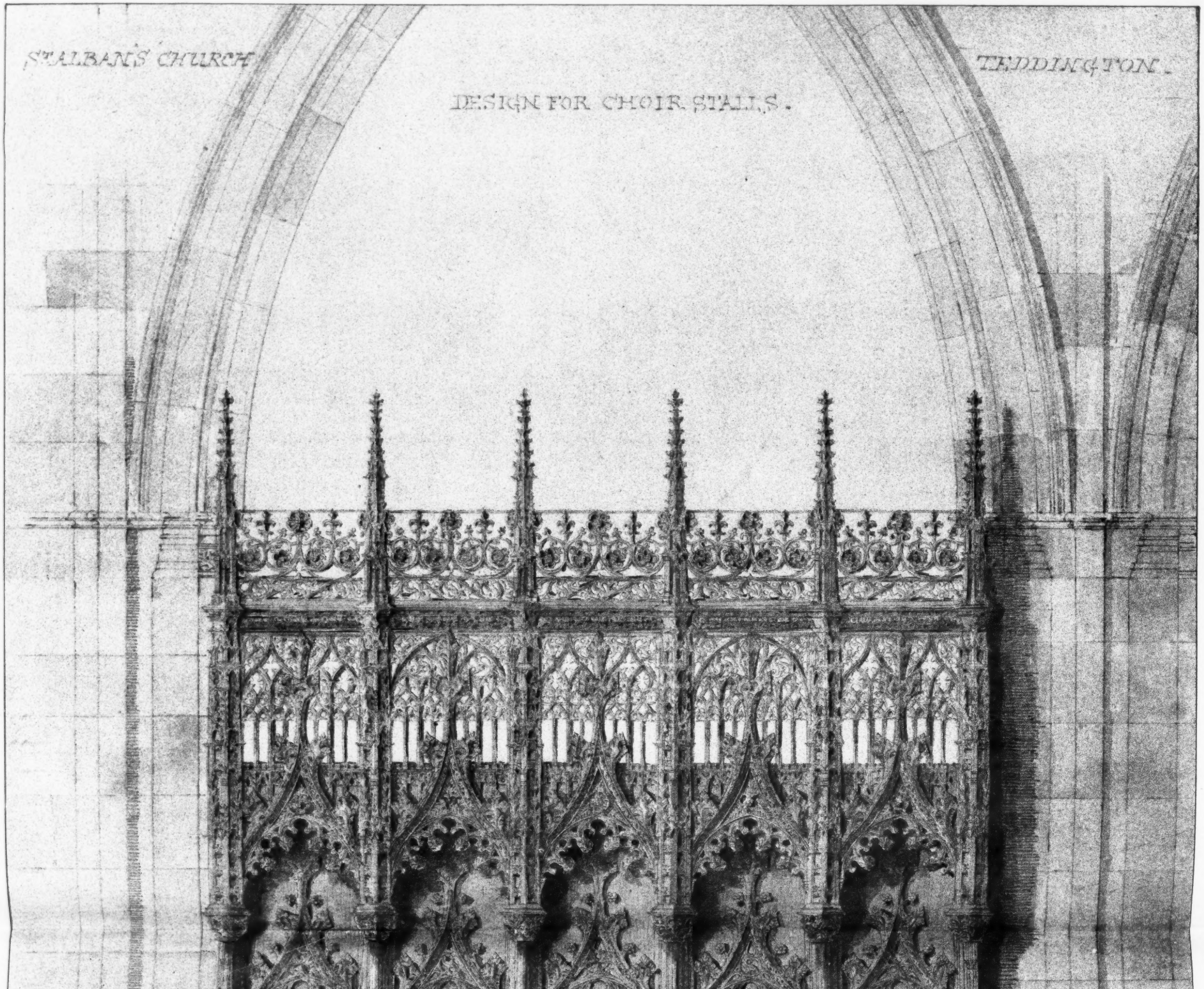

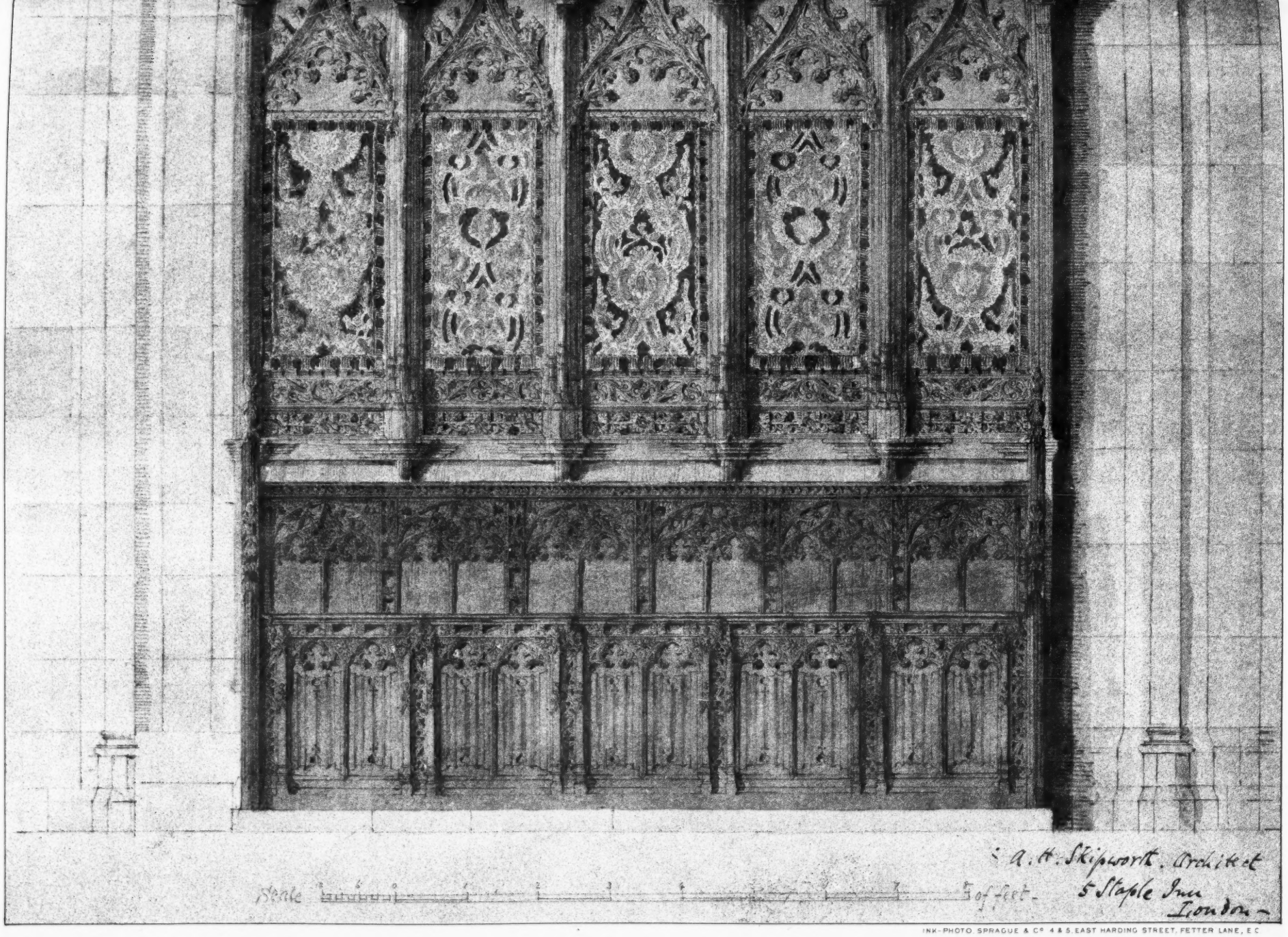

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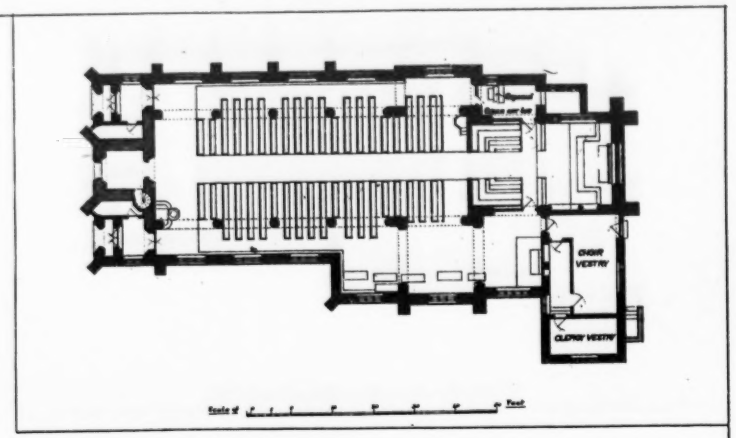
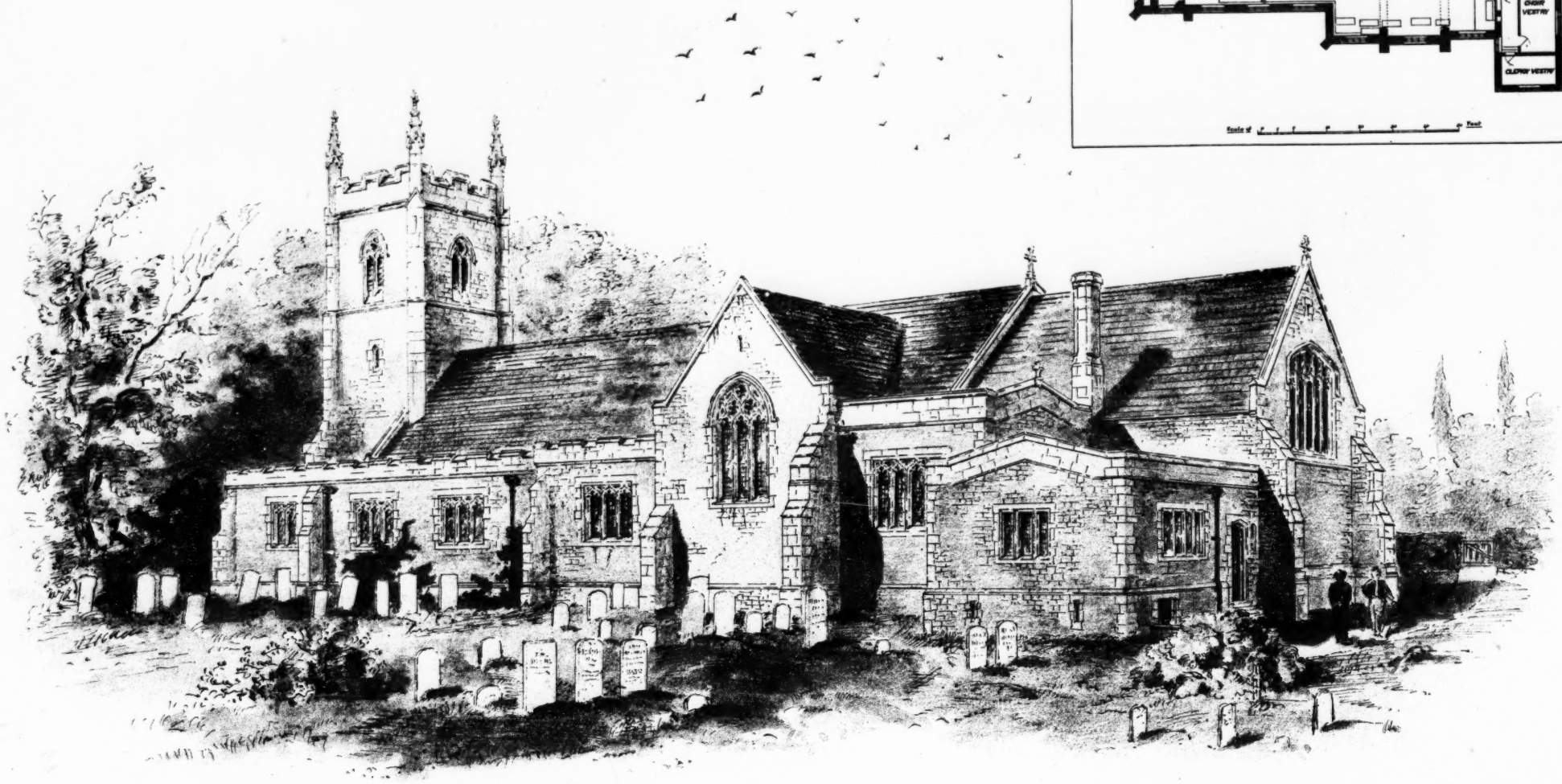
DESIGN FOR CHOIR STALLS: ST. ALBAN'S CHURCH, TEDDINGTON.—Mr. A. H. Skipworth, Architect.

Royal Academy Exhibition, 1891.





Morton Church.

J. T. Micklethwaite & Somers Clarke Architects.

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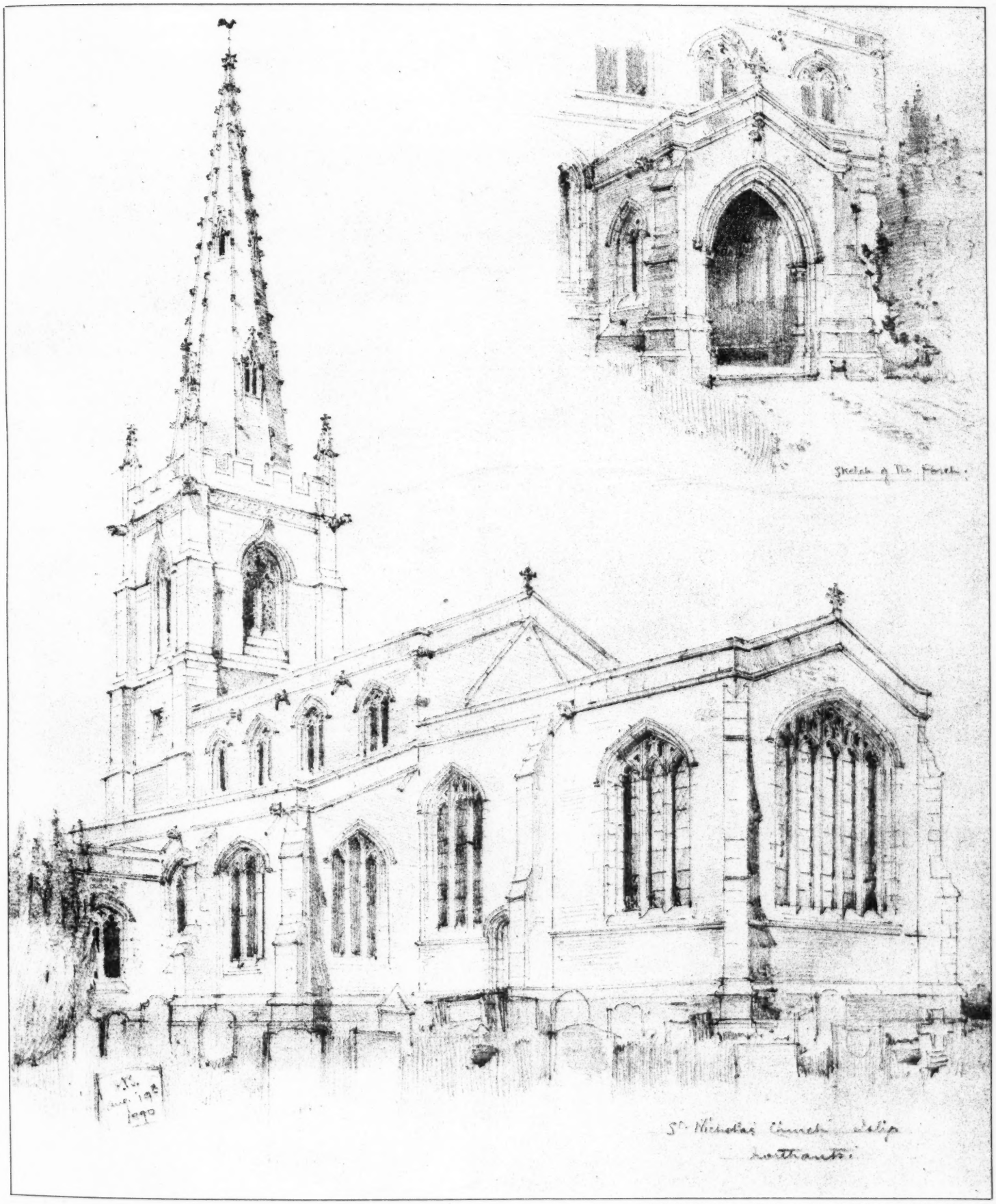

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ST. NICHOLAS, ISLIP.—From a Drawing by Mr. John Begg.